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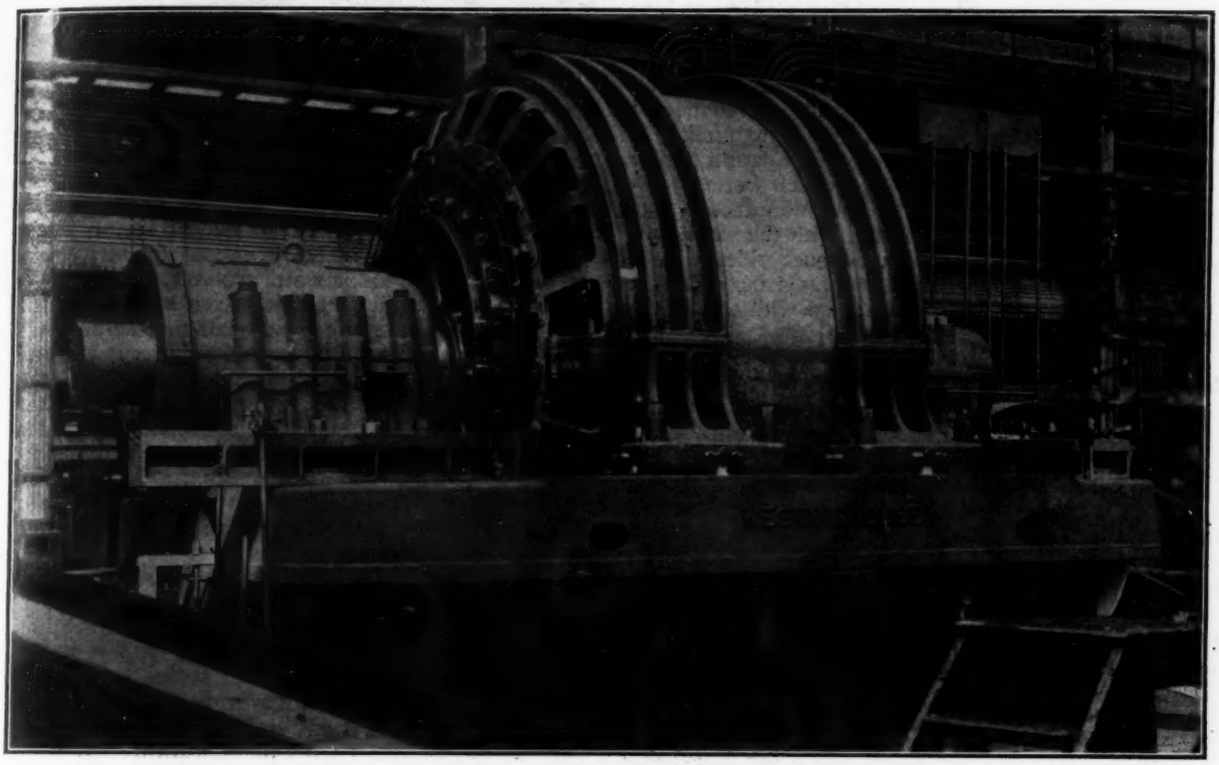


Type of Reversing Motor Used in Blooming Mill. Motor Rating Is 15,000 Horsepower.

Electrical Equipment of the Mark Steel Plant

Complete Electric Drive in Large New Plant Manufacturing Steel Conduit, Pipe and Plates—Power-House Equipment—Reversing-Mill Motors Up to 15,000 Horsepower

JOSEPH P. COLLOPY

BEFORE describing the electrical equipment of a large steel mill, a paragraph or two on the general operation of a modern steel mill may be of value to some readers.

The raw ore first enters the blast furnace. Here the metal is separated from the slag by means of a blast of high temperature. It leaves the blast furnaces in a still impure state, fairly high in carbon content. From the blast furnace, the metal is taken either to the open-hearth plant or the Bessemer plant. In the open-hearth process the carbon in the iron is oxidized by heating it with rusty scrap iron. In the Bessemer process the carbon is oxidized by blowing air through the iron after it has been heated to a high temperature. After the iron has been purified it is cast into ingots of various sizes, often about 18 inches square and 5 or 6 feet long.

When reheated, these ingots are sent to the rolling mill and passed between large rolls until the proper size and shape of product is reached. These rolls are the part of the process that take the largest amount of power. In the reversing mills the bar is put back and forth between the same rolls, which are reversed at brief intervals, the distance between the rolls being decreased each time. In the continuous process the bar to be rolled is passed continuously through two or

more sets of rolls until the desired product is in this way obtained.

General Features of the Mark Steel Plant.

The new steel rolling mill of the Mark Manufacturing Company is situated on the edge of Lake Michigan about one mile northwest of Indiana Harbor, Ind. The exact site upon which this large industrial plant now stands was but a few months ago several feet beneath the surface of this large body of water. The land was made accessible by building a pier out into the lake at a depth of about 50 feet and then filling in with sand pumped from the bottom of the lake a little farther out. Upon this foundation of sand, literally speaking, was placed this large and interconnected mass of buildings, machinery and related material.

All building piers and machinery foundation of any size were placed on wooden pilings which were capped with a length of spiral pipe filled with concrete. The frames of all buildings are of steel with the walls constructed by coating metal lath on both sides with a cement gun. This made a wall about 2 inches thick. The material used in the roofs varied with the different buildings.

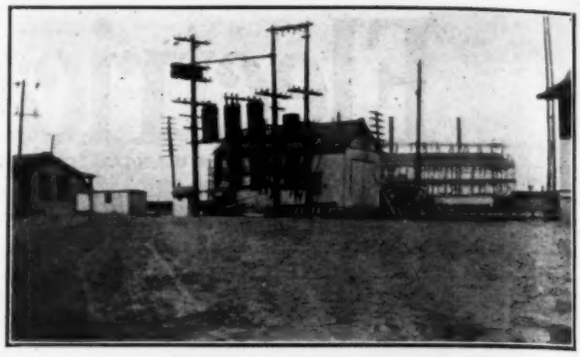
The purpose of this plant is to receive iron ore brought in by the large lake boats and turn it into finished pipe, conduit, plates, etc. The plant now consists of ore docks, a 50,000-kilowatt power house, blast furnace, open-hearth plant, soaking pits, blooming mill, billet mill, skelp mill, universal plate mill, pipe mill, large machine shop and gas-producer buildings; other buildings are to be added in the future.

Layout and Equipment of the Power Plant.

The entire plant is electrically driven, there being not a single prime mover outside the power house. The power house is situated in a central position with respect to the other buildings. It is divided into a boiler house and the power house proper. The electrical bay is built as a lean-to on one side of the turbine room. The main portion has two floors, the upper floor being about 25 feet above water line and the lower about 5 feet. The upper floor is occupied by the turbogenerators and two turboblowers for the blast furnace, while the air washers, condensers, vacuum pumps, service pumps, etc., occupy the lower floor. The electrical bay contains three floors. The upper floor, which is on a level with the turbine floor, is used as the operating and exciter floor; the middle floor is the switching room, and the lower is the cable room, from which the underground distributing lines are led.

The power-generating equipment consists of two turbogenerators of 6500 kilovolt-amperes each and one

General View of Mark Manufacturing Company's Steel Plant Near Indiana Harbor.



Substation That Furnished Power During Construction of Plant.

of 12,500 kilovolt-amperes capacity, with provisions made for the early addition of two more 12,500-kilovolt-ampere units. These units are all three-phase, 2300-volt, 60-cycle, 90-per cent power-factor, Westinghouse units. The exciters are separately driven and consist of two 150-kilowatt 250-volt, motor-driven units and one 90-kilowatt unit driven by a steam turbine. All pumps are either motor or turbine-driven.

The boiler room contains 12 600-horsepower boilers—6 are Babcock & Wilcox make and 6 are Casey-Hedges. The boilers are fed by chain-grate stokers with apron feed. The stokers are divided into two sections and each driven by a 15-horsepower induction motor. The drive is so arranged that a duplicate motor may be engaged at a moment's notice in case of failure of the other. The boiler-feed pumps are high-speed turbo-driven units.

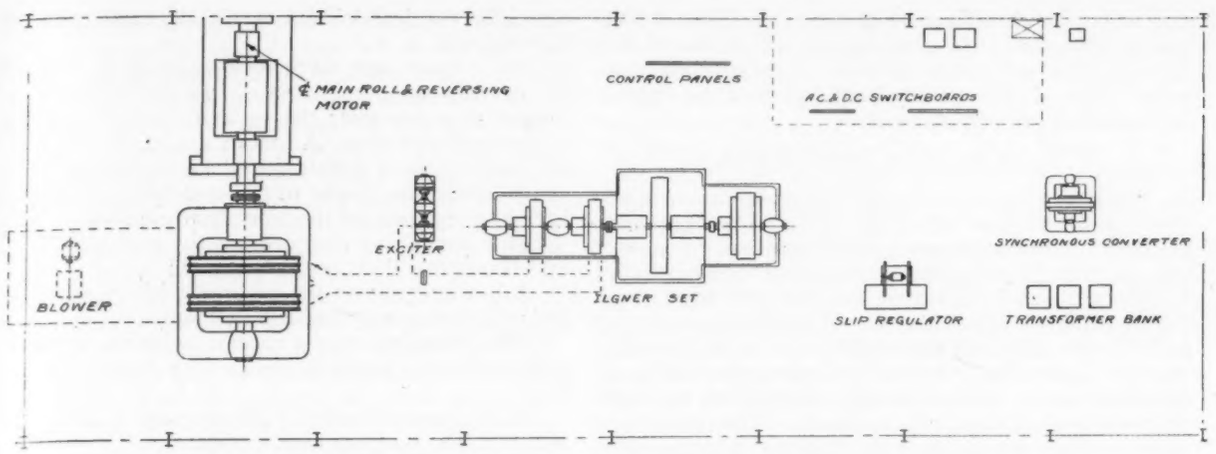
The ash skip is driven by a 15-horsepower, 230-volt, direct-current motor started by a push button and stopped at either end of the travel by track-limit switches. The ash car is propelled by a 7.5-horsepower, 230-volt series motor and is fed by two collector rails. The coal conveyor is run by two 15-horsepower, 440-volt induction motors. The elevator, which raises the coal from a pit beneath the car tracks to the conveyor, is also driven by a 15-horsepower, 440-volt induction motor.

The main bus, made up of six bars of ⅛ by 4-inch copper bars, is connected on the ring system. The bus structure is of reinforced concrete with barriers of transite between buses. The structure is divided into two parts, each being placed back to back. The power is fed from the generators to the oil switches and from the oil switches to the cable room through iron-pipe-size copper tubing. The feeds to the various substations and motor houses consist of a number of lead-sheath cables connected in parallel, the quantity depending upon load required. In case of failure of any cable, it may be removed and the load carried by the remaining conductors until the fault is remedied.

The light and power for the station is fed from the main bus in the same manner as the main feeds. The distributing panel is placed at one end of the switchboard room with the two power transformers of 100 kilovolt-amperes, 2200-440 volts and one 50 kilovolt-ampere, 2200-110-220-volt lighting transformer behind it. Reactances were placed between the oil switches and the transformers for protection in case of trouble on this short line.

The Distribution System.

The power house is centrally located with respect to the main buildings. All power is transmitted through underground conduit to the various substations and motor houses at 2300 volts. All the lines are



Plan of Blooming-Mill Motor House, Showing Location of Principal Equipment.

varnished-cambric lead-covered cables and the ducts are of 3½-inch fiber conduit. As mentioned before, the whole setting is nothing but freshly poured sand which does not make a uniformly firm foundation for the duct runs so that some provisions had to be made in order that the ducts would not crack and pinch the cable. Steel reinforcing rods were used both at the top and at the bottom of the runs and special precautions were taken where the ducts joined the manholes.

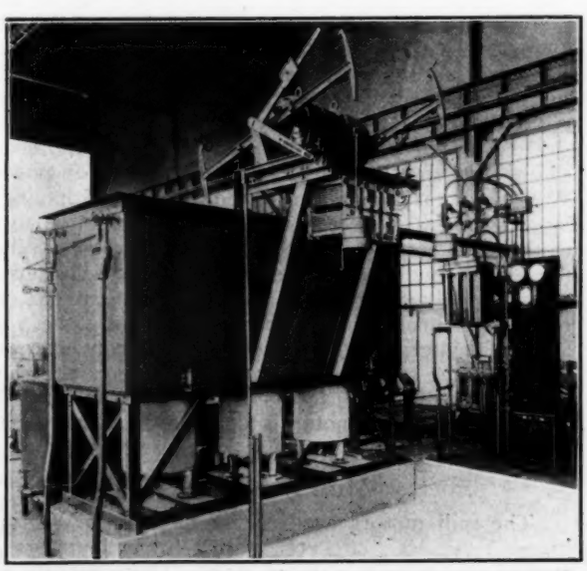
Every mill building has its own substation or motor house, which is located as near to the load center as possible. All the apparatus in the different substations is standard. The synchronous converters are all of 1000-kilowatt capacity, used in connection with a bank of 333-kilovolt-ampere transformers. The light and power transformers are of 50 and 100-kilovolt-amperes capacity, respectively. This scheme of standardization, which was carried out in all the electrical equipment, including motors, control panels and all the mill equipment, makes possible carrying the minimum amount of spare parts and lessens materially the confusion that is liable to occur in making rapid repairs.

The large motor-generator sets, the 2000-horsepower skelp-mill motors, and a few pump motors are driven directly from the 2300-volt, 60-cycle lines. All other alternating-current power was stepped down to 440 volts. The lighting voltage was stepped down to 115 volts. In most cases two power transformers were connected in open delta with provisions made for a third transformer in the future. The direct-current voltage of the synchronous converters is 230 and this current is used to drive numerous variable-speed mill motors. The direct-current buses of the different stations are connected by tie lines. Where the distance between stations is short, equalizer leads are used.

Reversing Rolling-Mill Motor House.

The rolling- mill motor house is the most interesting installation of the entire system and is, indeed, as interesting as any before the electrical engineer today. Nowhere else is theory and massive construction more harmoniously combined. The equipment for the three reversing mills in this plant is practically the same except for a variation in size. It consists of a Westinghouse-Ilgner set, No. 4 slip regulator, reversing motor, double exciter set and magnetic control. A synchronous converter is installed in the motor house to provide current for the auxiliary mill motors. The reversing motors for the billet mill and universal-plate mill are single-frame motors of 5000 and 8000 horsepower maximum effort, respectively, while the blooming-mill reversing motor is capable of delivering 15,000 horsepower and is a two-frame motor with two armatures on the same shaft. The flywheel set for this motor includes two direct-current generators connected in series.

These sets may seem complicated and clumsy, but the entire set is controlled by a simple master switch. The Ilgner set consists of an alternating-current wound-rotor induction motor, a flywheel of about 80,000 pounds for a 5000-horsepower set, and a 600-volt direct-current generator. The exciter set consists of a variable and a constant-voltage generator driven by a motor. The slip regulator, which is simply a liquid rheostat, is controlled by a torque motor connected to series transformers in the main line. As the load increases, the torque motor becomes energized enough to lift the plates farther apart and increases the resistance, thereby increasing the torque of the main motor. The reversing motor is controlled by changing the voltage of the generator. The field resistance is connected in a closed ring and the contacts are so arranged that full field in one direction may be gradually changed to zero and then to full field in the opposite direction, thereby driving the motor at full speed in one direction, reversing, and then driving it at full speed in the opposite direction. The speed is



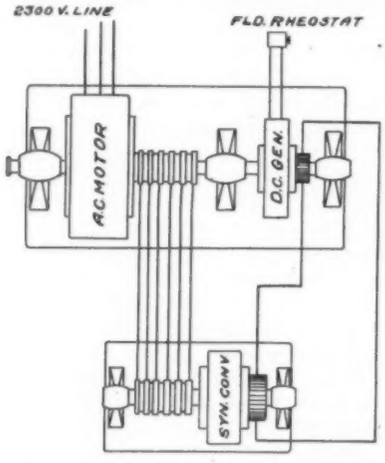
Type of Automatic Slip Regulator Used on Ilgner Set for Reversing Mills.

also varied by changing the motor field. This double control makes possible a smaller generator than if the full range of speed was secured by varying the generator field. The flywheel absorbs part of the sudden load at the beginning of a pass.

The Skelp-Mill Motor House.

The equipment of the skelp-mill motor house is entirely different from the other mills. The skelp mill employs a continuous process and requires no reversing; however, it requires accurate speed control. This is accomplished by a clever but not new method of induction-motor speed control. There are two drives, one for the roughing stand and one for the finishing stand. Each drive consists of three units, the main induction motor and a direct-current unit on the same shaft, and a synchronous converter. The motor is a 2000-horsepower, three-phase, 60-cycle induction motor. The generator is a 550-kilowatt unit, generating between zero and 550 volts. The synchronous converter is a standard unit of 500-kilowatt capacity.

In starting, neither the rotary converter nor the direct-current generator is used. Instead, a set of resistors is connected to the wound motor. The motor is brought up to speed by gradually cutting out the



Scheme of Connections Used on Alternating-Motor Control in Skelp Mill.

resistors by means of magnetic switches. After the motor is up to speed, the direct-current generator is connected to the synchronous converter. Then the speed is controlled by varying the shunt field of the direct-current unit.

It would be possible to control the motor by means of the resistors, but it would be wasteful of power. With the rotary-converter system, instead of having a large I^2R loss in the rotor, a back electromotive force of the same frequency as the rotor is impressed. When the field of the direct-current unit is increased there is a higher voltage across it and the direct-current end of the synchronous converter, consequently the voltage at the alternating-current end of the converter and therefore the counter electromotive force of the rotor (which is connected across it) is increased and the speed of the large motor is decreased. A very constant speed has been secured with these sets.

Rolling-Mill Auxiliary Motors.

The mill motors are for the most part Westinghouse type MC, 230-volt, direct-current motors—a rugged and totally inclosed type. These motors are not intended for continuous service but are designed especially for intermittent service in connection with the steel mill.

The motors are all magnetically controlled with the control panels mounted on the mill floor and arranged in a row near the wall of the building, quite well out of the way. A bus of 4-inch copper bars is run behind these panels for the general feed. The control resistors, mostly of the grid type, are mounted back of the panels on the pipe-structure supports.

The controllers that are mostly used are divided into four general classes, as follows:

AA—Plugging on the reverse, without speed control; acceleration by lockout switches.

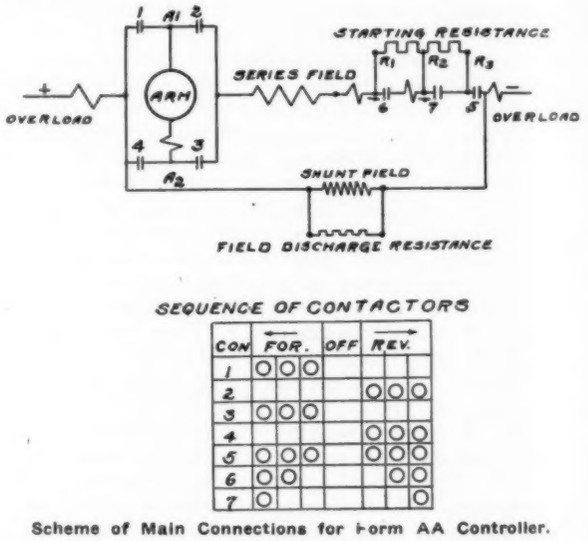
BB—Plugging on the reverse, with speed control; acceleration by shunt switches with current-limit relays.

CC—Dynamic brake without speed control; lockout switches used for acceleration.

DD—Dynamic brake with speed control; acceleration by shunt switches with current-limit relays.

The use of the above classes is as follows:

Class AA is used on the mill-table rollers and ingot buggy.



SEQUENCE OF CONTACTORS

CON	← FOR.			OFF	REV. →		
1	○	○	○				
2					○	○	○
3	○	○	○				
4					○	○	○
5	○	○	○		○	○	○
6	○	○				○	○
7	○						○

Scheme of Main Connections for Form AA Controller.

The motor is automatically accelerated by means of the series lockout switches 6 and 7, which are operated by series coils. The motor is driven forward or reverse by the closing of contactors 1 and 3 or 2 and 4.

Class BB is used on the straightening machine and straightening tables in the universal mill and wherever speed control was desired.

Class CC is used for the screwdown motors and manipulator fingers.

Class DD is used on shear-approach tables and on the runout tables.

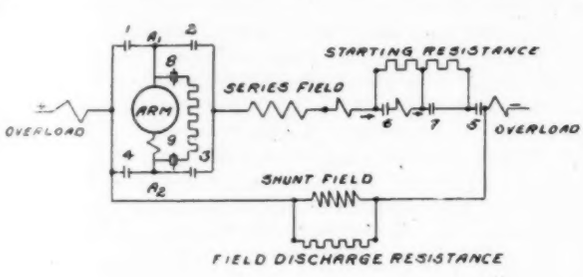
In some cases these classes were altered to suit different operations. On the blooming-mill screwdown, two motors are used. The control of these is such that the motors are operated in parallel when the rolls are being lifted and in series when the rolls are being lowered. The motors are started and stopped by means of a two-point or a six-point master switch. Six-point masters are used where speed control is desired. The two-point masters are mounted on a 2-inch iron pipe stand while the six-point ones are mounted directly on the floor.

In a number of places limit switches are used in order to stop the motor at the proper time. The limit switches used are of two types, the geared and the track. When the geared switch is used the actuating

shaft is geared directly to the mechanism. On this shaft is mounted a set of cams which operate the switch at the proper time. The track limit switches are located where some part of the mechanism will hit the switch at the proper time and stop the motor.

The shears are the only machines in the mills driven by alternating-current motors. These are driven by 440-volt type CW motors and are connected to drum controls. The large shears are equipped with flywheels and the motor runs continuously. The shear is brought into action by closing a clutch.

In two of the mills it was determined that some of the mill motors specified by the mill manufacturers were not large enough to run at the required rate without overheating. Due to the slow delivery of equipment, it was out of the question to secure larger motors. Instead, the motors delivered were cooled by forced ventilation. The air was led from a blower in the motor house pit through a 12-inch tile duct and smaller taps were taken off for each motor. The inspection plates above the commutators were removed



SEQUENCE OF CONTACTORS

CON	FOR.			OFF	REV		
1	○	○	○				
2					○	○	○
3	○	○	○				
4					○	○	○
5	○	○	○		○	○	○
6	○	○				○	○
7	○						○
8				○	○	○	○
9	○	○	○	○			

Scheme of Main Connections for Form CC Controller.

This controller is the same as Form AA, except that it is arranged for dynamic braking. The brake resistor is connected across the armature by contactors 8 and 9. These contactors are so arranged that they will not close until 1 and 4 are both open. They are held closed by the dynamic-braking current passing through series coils.

and special covers, made of cast iron carefully screened, provided in their places.

Equipment for Pipe Mills and Miscellaneous Departments.

The pipe mills are the only mills in which alternating-current motors are used to any extent; the motors here are all alternating-current except five. The largest motor used is a 150-horsepower, 440-volt, three-phase induction motor, running at 500 revolutions per minute, and is used to drive the lap-weld machine. These alternating-current motors are equipped with autostarters, except a few small ones, which are thrown directly on the line.

The ore-dock equipment, at present, consists of one bridge and two unloaders. All the traverse motors are of the regular railway type. The hoisting motors are of the MC type. Both magnetic and drum controls are used.

The blast-furnace equipment consists of two motors, a skip-hoist motor and a small passenger-elevator motor. The skip-hoist motor is a 200-horsepower, 230-volt, direct-current, adjustable-sped motor, controlled by a Cutler-Hammer special control. An auxiliary control is also installed in case of failure of the regular equipment. This is made necessary because of the serious nature of any delay in feeding the furnace.

The machine-shop equipment is all driven by individual motors controlled by Westinghouse standard machine-shop controls.

A very important part of steel-mill equipment is the cranes. In most cases the cranes are in constant use and any breakdown of their equipment is to be avoided. The main and auxiliary hoists are equipped with class EE control; the trolley with drum control and the bridge with class AA control. All the hoists are protected by E. C. & M. Youngstown safety limit stops and by Westinghouse type ET series overload relays.

Illumination of Buildings.

The buildings are all high and the large number of glass windows makes the illumination by day very good. The artificial illumination is also of the very best. General overhead illumination is used in all cases with occasional additions of wall brackets where bench work is carried on. The lighting current is secured from one or more 2200 to 110-220-volt transformers for each principal building. The distribution cabinets are of the standard steel construction. No conduit smaller than ¾ inch was used, nor any wire smaller than No. 12 B. & S. gauge. All the reflectors are of the steel enameled type. The large units are all Mazda C lamps. All overhead lights are located well above the cranes. About 0.60 watt per square foot was used in the power house, 0.50 watt per square foot in the substations, 0.40 watt per squart foot in the mills, and 0.36 watt per square foot in the open-hearth building. These values gave very good results.

The crane runways outside were illuminated by bracket lights that throw nearly all the light into the runway with little wasted on the outside. In addition to these a number of lights were fastened beneath the crane beams and fed from the 230-volt crane rail. Two 115-volt lamps were used in series.

In a few places about the yards, flood lighting was used to good advantage. On the power-house walls, ornamental wall brackets were used; this was the only place that any attempt at ornamental lighting was made.

Numerous plug receptacles were installed about the plant at convenient locations. These were mounted on the building walls about 4 feet from the floor and connected to circuits independent of the lighting circuits.

Intercommunicating Telephone System.

A telephone system is a very important factor in the electrical equipment of a steel mill. By means of the telephone, the men of the numerous buildings are brought into closer contact.

The automatic telephone system was installed here. The operating board was placed in the power house and was connected to the different telephones by No. 20 paper-insulated multiple-conductor cable, run through the underground duct runs. The signaling system in connection with the telephones consists of about twenty 6-inch single-stroke gongs in series on a 230-volt direct-current line. The automatic call operates a relay, which in turn closes the 230-volt circuit. These single-stroke bells have no contacts and are almost immune from trouble.

Interesting Underground Distributing System at Astoria, Oregon

Characteristics of Sub-Soil and Subterranean Construction Such that Gas, Telephone and Electric Systems Are Conveniently Routed—Details of Electrical Distribution

THE distributing system at Astoria, Ore., is a rather interesting one, because it represents a complete remodeling of the downtown distributing system in a way that adapted it to somewhat unique local conditions.

The city of Astoria is situated on a strip of land lying between the Columbia River and Young's River. The residential district occupies the hillside and the business section the low section along the river front. With the growth of the city the business section gradually extended out further until it reached a width of about four blocks in which the streets and buildings were supported on piling over the water. It was necessary to replace this piling and also the plank streets every few years and it soon became an expensive foundation for a business district. There was also the inconvenience of having no basement space or sewerage system.

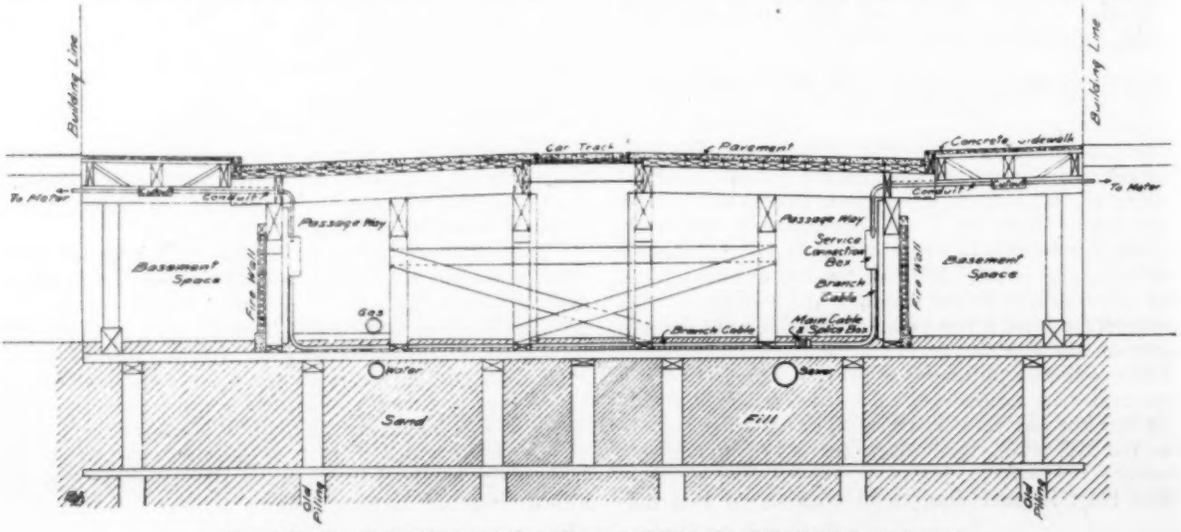
Early in 1914 the city created a Sanitary and Reclamation Commission with power to better conditions. A rock sea wall was built along the outer edge of the business district the entire length of the water front and sand was pumped in from the river, making a fill under the business district averaging about 11 feet in depth and extending some 2 or 3 feet above the high tide level. As the street grades in this district were raised about 4½ feet to a new level averaging about 9½ feet above the surface of the sand fill, almost every building in the business district had to be raised.

The accompanying illustration shows a cross section of the completed street. The old piling was cut off below the surface of the sand fill and, with caps and stringers, constitutes the foundation for the street supporting structure. Eight rows of posts run the length of the street. The rows nearest the property line support the sidewalks and have no bracing to interfere with the basement space under the sidewalk. The next adjoining rows have bracing running lengthwise of the street and along these rows run tile walls, so-called "fire-walls." The four rows of posts supporting the central portion of the street are braced among themselves in both directions. This construction allows a passageway on either side adjoining the fire wall and in these passageways are located the various utility systems.

The sewerage and water systems, which are buried in the sand, one on either side the street, were installed by the city. The telegraph and telephone companies' circuits are carried by bracket construction and cables are supported from the viaduct framework. The gas distributing system, installed by the Pacific Power & Light Company is ideal in that the mains are not buried but are carried on supports slightly above the sand level, and all connections, valves, services, etc., are in plain sight. Coated and wrapped steel pipe with patented couplings was used.

The electric system presented the greatest problem, as it is well known that underground electric construction quickly runs into money.

The height of the old street surface above the solid ground made it necessary to use 60 to 70-foot poles for supporting the electric light and power circuits. Consequently, practically all of the lines were routed through the main streets, where the heaviest loads were located, and, as the city grew, the number of wires increased until there was a veritable network of overhead construction, and to this, of course, was added the telephone company's overhead system. The city decided that, with the other street improvements, the wires should be placed underground to insure a more sightly business district. The layout finally approved by the city permitted overhead construction on the cross streets, running north and south, provided



Cross Section of Roadbed and Gas, Sewer and Electric Distribution at Astoria.

all circuits were removed from main thoroughfares, running east and west. This made it possible to eliminate primary and arc circuits from the underground system. Conforming to this plan, the main overhead primary feeders were rerouted to an east and west street paralleling the business district and branch overhead primary lines were carried down the north and south streets to transformer poles, which were located about 30 feet back from the intersections with the main east and west business streets. These poles were made the point of entrance for the underground secondary cables.

A thorough study was made of the load conditions and the underground system was designed to handle not only the present loads, but any normal increase for a number of years to come. As it was necessary to provide both lighting and three-phase power service, a 4-conductor cable was selected. This cable is paper insulated, lead sheathed and protected by two layers of spiral steel tape and jute servings. The secondary leads of the transformers are connected to the underground cables through 4-conductor potheads mounted on crossarms. The cables extend down the poles to the level of the sand fill, being protected by galvanized iron conduit from the sand level to a point about 10 feet above the sidewalk. From the bases of the poles the cables are buried in the sand, about 1 foot beneath the surface, without conduit, duct or other protection. As this sand is only a few feet above the high tide level, it is more or less damp at all times and should serve as an excellent means for conducting the heat away from the cables. The district fed from each transformer bank, which consists of two transformers connected in open delta, extends from middle of block to middle of block. The arrangement provides two cables for each district, both running from the transformers along the north and south streets to the intersection with the east and west streets, where they turn in opposite directions and extend to the middle of the block. This allows the lighting loads to be divided evenly between the two transformers. At the middle of the block the cables from each direction terminate in a connection or sectionalizing box, which consists of a watertight compartment in which are two sets of four contact jaws each, to which the conductors are connected; removable blades serve to connect the two districts, which are normally left separated. The purpose of this connection box is to insure quick resumption of service in case of transformer burnout, or other failure, in either district, and to bank the transformers in multiple in the event of heavy overload on one district.

The customers' services are not connected directly to the main cables, but lateral or branch cables are tapped off approximately every hundred feet through splice boxes, which are filled solid with compound. These branch cables run to either side of the street, where they rise to service connection boxes mounted on the fire wall, as shown in the illustration. These service connection boxes are made of sheet iron, similar to a cabinet box, and each one contains a lead pothead, in which the branch cable terminates, and a slate connection panel on which are mounted four copper current studs. The customers' services enter the top of this box through conduit and are directly connected to the current studs. This box is sealed and is not opened except for connects or disconnects. It is intended that the customers' services should extend through the fire wall at the property line nearest the service connection box, as this allows two buildings to be served without an extensive service run, but where there is more than one building to a lot it is sometimes necessary to run conduit from the service connection box along the fire wall to the building line. Just beyond the fire wall, on the property side, the service enters a fused cutout switch, mounted in an iron box, which is used as the main entrance fuse and emergency cutout in case of fire. The point of division in ownership of equipment is at the fire wall, the company owning all that portion of the service on the street side and the customer all on the property side. The company's requirements, however, demand that all inside wiring be enclosed in conduit to the motor. As there is more or less vibration of the viaduct timbers, due to traffic, it was decided that no meters should be mounted on any of the street supporting structures.

No important defects have developed and there is every reason to believe that it will be a very satisfactory and economical installation, under the conditions.

ELECTRICAL DEVELOPMENT IN BRITISH INDIA.

The Madras Public Works Department of British India in a report for the year 1916-17 directs attention to the greater use of electricity for different purposes. It states that the increased use of electricity in Madras city is well maintained. The number of consumers at the end of the year 1916 had increased from 2009 to 2305 and the quantity of electricity sold from 5,086,609 units to 5,693,807 units. About 54 industrial concerns comprising various mills, presses and factories are being worked with electric power. Up to the end of 1916 the total mileage of overhead and underground mains of the local supply company was 72, as against 68 miles of such mains up to the end of 1915. The increased demand for energy has necessitated additional substations in Georgetown and on Mount Road. The suburban extensions to Kilpauk, Royapuram and Adyar have been further delayed by the difficulties of obtaining materials.

Considerable progress in the street lighting of Madras city is being made. Up to the end of March, 1917, close to 17 miles of street lighting mains had been laid with a total number of 2138 lights and a total expenditure of nearly 376,000 rupees ($121,987). The capital cost of the electric installations under the public works department maintenance was 1,029,650 rupees ($334,053), and the amount spent on their maintenance apart from actual consumption charges was 36,951 rupees ($11,988). There are 129 electric plants in the Presidency notifiable under the act.

As in previous years the standard of work of the majority of electrical contractors is decidedly poor. The subject of licensing wiring contractors gave rise to considerable discussion at the recent conference at Calcutta of government electrical inspectors and engineers, and the best way to carry out the licensing is under consideration. The matter has been taken up by the director of industries and there is a proposal that a wiremen's class shall be opened at the trades' school.

All electric properties of H. M. Byllesby & Company reporting for the week ended April 27 show the following new business gains (net)—362 customers with 343 kilowatts of lighting. New business contracted for includes 1332 customers with 583 kilowatts of lighting and 571 horsepower in motors. There was a gain of 21.8 per cent in electric energy output over the corresponding period last year.

Editorial Comment

Seasonal Rating of Underground Cables

WITH the passing of the cold, wet weather and the coming of the hot, dry months operating engineers turn their attention to the seasonal capacity of their underground cables. Experience has long demonstrated that ordinarily underground cables have lower current-carrying capacity during the summer months than during the winter, and failure to appreciate this fact has resulted in many cable breakdowns and service interruptions. To prevent undue operating expense and service interruptions on the one hand and yet permit full utilization of underground transmitting conductors and the investment sunk in them on the other it is important that the seasonal rating of underground cables be known as closely as possible.

Much valuable information has been compiled and made available through the medium of the A. I. E. E. and N. E. L. A. on the heating and current-carrying capacity of underground cables; empirical formulas and constants, and other data tending toward predetermination of results have been developed. However, there are so many unknown and variable quantities, not in the cable so much as in the surrounding soil, and other extraneous factors, that seasonal ratings are almost invariably based not upon calculation but upon operating experience, that is, practical trial. In some cases thermo-couples, thermometers and exploring coils have been installed upon and in cables at the suppositional hot spots and other ways have been used for determining the heating, but these methods are not entirely satisfactory, give no real feeling of security, are expensive and usually not applicable to the average company nor in any case to the entire underground transmission system. The cut and try method thus remains the one upon which the seasonal rating of a cable depends.

Various methods have been recommended and adopted in a somewhat restricted way for extending the capacity of underground cables during the hot dry seasons. Artificial and natural cooling by the circulation of air through the cable ducts; circulation of water around the cable and hydration of the surrounding soil, and immersion of the cable in highly heat-conducting materials are some of the ways proposed and in use, with varying degrees of efficiency.

The heavy loads of the last six months, the rains and prolonged cold weather have encouraged the overloading of underground cables, with apparently no untoward outward effect. The thing to remember now, however, is that with the coming of dry weather the surface and sub-soils dry out, and thus tend to become insulators instead of conductors of heat. The resistance of earth plates may increase, shunting current to neighboring cable sheaths, still further increasing the heating of the cables, and making hot spots more probable, because of variation of soil characteristics and the absence of equalizing moisture.

High-voltage cables require greater care than those for the lower voltages. With the latter the I^2R loss is the chief cause of heating, a loss fairly uniformly distributed along the cable, except for variation of resistances internally due to splices and so forth, and variations of the soil characteristics on the outside. With high-voltage cables, on the other hand, the heating due the dielectric loss is superimposed upon that chargeable to the I^2R loss. Dielectric losses increase with increasing temperature, the effect is cumulative, hence special precautions to guard against self-destruction caused by a combination of dielectric and I^2R loss are advisable with high-voltage cables. In many instances of heating it has been found that after a certain temperature has been attained the dielectric loss has been sufficient to cause breakdown, due the cumulative effect of temperature and resistance. Taking voltage off a line when not needed, using duplicate lines alternately, giving each a rest, in such cases prolongs the life of a cable and decreases breakdowns.

Although more cable failures may be expected during the summer than during the winter it is unwise to place the entire blame upon the soil and the media surrounding the cable. In some cases there has been good reason to believe that the human element is responsible for a part at least of the increased cable failures during hot months. Hot weather, hurried work, and uncomfortable quarters in the manholes are not conducive to first-class workmanship, and a little carelessness, and a little perspiration falling into the splice contribute to another cable failure. This is the simplest explanation as to why a repaired splice seems to fail more frequently in the summer than during the winter. Making a manhole as comfortable as possible with exhaust and ventilating fan is a good policy, for good workmanship does not usually accompany poor working conditions.

Whatever the predominating or contributing factors causing increased cable failures during the summer months, it is well to bear in mind that underground cables, like men and beasts, cannot be worked as hard during hot, dry weather as during cold, wet weather without running the risk of serious consequences. For most companies the criterion as to how hard to work their cables in either winter or summer is one to be decided by experience. In some cases the summer rating is only 50 per cent of the winter rating, but carefully kept operating records will deter-

mine how far it is safe to go. Meanwhile empty ducts can be cleaned, manhole vents and other means of permitting free circulation of air and similar methods that can be cheaply and conveniently employed tending to equalize the seasonal rating of underground cables should not go unutilized.

The Coal Situation

NOTWITHSTANDING the stress laid by federal, state and other organizations upon the vital need of producing coal at the maximum rate possible, maximum coal production does not obtain. Many mines are remaining idle because with coal prices fixed it does not pay to operate them, many mines are working far below capacity, and miners are, at best, working only intermittently. Mine operators claim either that the railroads are unable to furnish sufficient cars for their output, or that there is insufficient demand by the consumer for coal to keep them working full time.

The coal situation is not at all satisfactory. There is urgent need for co-operation—co-operation between mine operator and miner, between mine operator and the railroads, and between dealer and consumer, because the flow of coal from mine to point of consumption embraces action by each of these. Summed up, there is extreme need for co-operation between the railroad and fuel administrations and the public. There appears lack of harmony between the railroad and fuel administrations. And then, the public is not backing up the fuel administration in its request to buy coal now. Coal consumers have been asked to order their coal now and thus by keeping down the peak of coal production and transportation later, permit both miners and railroads to work more efficiently. But the coal consumers of the country are not doing this. Some do not appreciate the seriousness of the situation; others are not able to pay in advance for coal they will not need for many months to come.

The public is not standing by the fuel administration and a very serious fuel shortage, worse than that encountered during the last winter, is threatened. Washington claims the coal shortage next winter will amount to 75,000,000 tons unless conditions improve, and radically. The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society of Civil Engineers and the American Society of Mining Engineers have stated they believe their co-operative effort will enable a guaranteed saving of 40,000,000 tons of coal this year by reducing waste and needless use of coal. The zone system of distribution, really a factor in the solution of the railroad situation, has already made available thousands of cars for accelerating the movement of coal. The clean-coal ruling, insofar as it may be enforced, will, it is estimated, reduce the tonnage of coal hauled by some 30,000,000 tons annually, which, apart from lowering the nation's coal bill some $120,000,000, will make many cars available. The weeding out of non-essential industries and the improvement of coal-burning plants are also adding their quota to the reducing of coal consumption and making available more cars for more fuel.

But more important than decreased consumption is increased production, for the former cannot be reduced practically beyond a certain point, whereas the latter can be increased enough to accomplish the purpose. Production of coal depends upon the ability of the railroads to transport the coal produced. And the coal produced, provided transportation permits, depends upon the demand.

The prosecution of the war, the best interests of the nation, and the general welfare of the nation and its allies demand that coal production be sustained at the maximum rate possible only when the fuel and railroad administrations and the consumers of coal co-operate to the fullest extent. It is hoped the railroads will wake up and realize what is expected of them, and put aside petty politics, jealousies or whatever it is that now appears to be clogging the nation's progress in the war. To the coal consumers of the country we implore them to buy their coal now. The production of coal follows the law of supply and demand. Buy your coal now.

Safegaurding Investments in Material Stocks

ONE of the most perplexing problems for many manufacturers and dealers to decide is the amount they are willing to invest in stocks of raw materials and finished products. Prices have risen so surely and so long that the investment in materials is causing anxiety to many manufacturers and dealers, whose working capital is tied up or who need to use their stocks as collateral. When the war is won prices will drop; when, how much and how rapidly, no one can tell.

One the one hand there can be no doubt as to the financial risk of carrying large stocks bought at reigning prices, unless there is assurance that this investment can be converted before prices drop. On the other hand, there is no denying the seriousness to industry and the country as a whole following inability to obtain materials and products from stock without protracted delays. The country needs ample supplies on hand ready when needed. Those carrying them must be protected against the contingencies of war.

Great Britain is already formulating precautions for safeguarding manufacturers and others against financial loss when a decline in prices comes. She realizes generous stocks in certain commodities are necessary for the country's welfare, and, further, that the risk should not be borne solely by those that carry them. We here might well turn our attention to this same post-bellum matter now, otherwise lack of stocks will not only hinder our progress now, but will find us unprepared when world trade opens after the war is won.

Week's Events

Coast Electrical Men Meet—Edison Medal to Col. Carty —Electric Welding Tested—Program of Institute Convention

PACIFIC COAST ELECTRICAL INTERESTS MEET UNDER AUSPICES OF N. E. L. A.

War-Service Problems Feature of Sessions—All Branches Strongly Represented.

A joint convention of all branches of the electrical industry on the Pacific Coast, under the auspices of the Pacific Coast Section, National Electric Light Association, was held at Del Monte, Cal., May 9, 10 and 11. The three days' sessions were devoted principally to war-service problems as they appear from the standpoint of the several sections of the industry there represented. Great enthusiasm was manifested by the 400 delegates in attendance at these war-service sessions, which were the striking features of the convention. The sessions were characterized by strong representation on the part of the State Railroad Commission, the central stations, electrical jobbers, dealers, contractors and manufacturers, whose efforts were exerted to bring about harmonious and efficient relations among all branches concerned, and to be of the utmost service to the Government in developing and distributing hydroelectric power.

The sessions of Thursday and Friday were devoted to the elaborate program, covering many phases of service having a special bearing on the nation's war problems, and the efficient application of all resources and utilities to the solution of those problems. These features were presented in addresses, discussion, committee reports and resolutions, covering a wide range of interests. Throughout, the patriotic spirit dominated the sessions.

Saturday was given over to a business meeting, a gathering for outdoor sports, and a 17-mile automobile drive.

The joint convention was preceded, on Monday, by a Pacific Coast meeting of the National Electric Supply Jobbers' Association; and on Wednesday by a meeting of the California Association of Electrical Contractors and Dealers. The three conventions brought to Del Monte many of the active representatives of an industry which constitutes one of the dynamic forces of the nation.

AMERICAN ASSOCIATION OF ENGINEERS ANNOUNCES NOMINATIONS.

Election of Officers to Be Held at Annual Meeting in Chicago May 14.

The American Association of Engineers, at the annual convention to be held in the City Club, Chicago, May 14, will elect a president and a board of directors, the nominations for which, recently announced, are as follows:

President—W. H. Finley, chief engineer, C. & N. W. Ry.

First vice-president—H. W. Clausen, construction engineer, city of Chicago.

Second vice president—L. K. Sherman, Chicago, president, L. K. Sherman Company, engineers; A. D. Whipple, Chicago, chief engineer, Portland Cement Association.

Directors—Harold Almert, consulting engineer, Chicago; F. K. Bennett, Minneapolis, assistant chief engineer, M. & St. L. Ry.; T. M. Chapman, Savannah, Ga., land and tax engineer, C. of Ga. Ry.; C. U. Freund, civil engineer, Washington, D. C.; W. A. Goss, Chicago, engineer, Interstate Commerce Commission; J. N. Hatch, Chicago, consulting engineer; Samuel Moreell, engineer of bridges, City of Chicago; Chas. A. Morey, president, Chicago Technical College; Alexander Potter, New York, consulting engineer; J. H. Prior, Chicago, consulting engineer; Warwick Ray, Chicago, engineer, Western Electric Co.; C. B. Reed, Chicago, engineer, Illinois Central Railway; E. O. Schweitzer, Chicago, chief testing engineer, Commonwealth Edison Company; C. B. Scott, Richmond, member, Virginia State Highway Commission; F. L. Thompson, Chicago, assistant chief engineer, I. C. R. R.; P. B. Waldin, Pittsburgh, district sales manager, Marchant Calculating Machine Company; F. R. Weller, Washington, Consulting Engineer.

EDISON MEDAL TO BE PRESENTED TO COLONEL JOHN J. CARTY.

Award Made for Work in Telephone Engineering—Presentation Ceremonies to Be Held May 17.

The eighth Edison Medal has been awarded by the Edison Medal Committee of the American Institute of Electrical Engineers to Colonel John Joseph Carty for his work in the science and art of telephone engineering. The medal will be presented to Colonel Carty at the annual meeting of the Institute to be held in the auditorium of the Engineering Societies Building, New York City, May 17, 1918, at 8:30 p. m. President E. W. Rice, Jr., will preside and the program will be as follows:

Address by A. E. Kennelly, outlining the origin and purpose of the Edison Medal.

Address by Michael I. Pupin, giving history of Colonel Carty's work in regard to telephone engineering.

Presentation of medal to Colonel Carty by President E. W. Rice, Jr., followed by the acceptance of the medal by Colonel Carty.

The Edison Medal was established upon the initiative of a group of friends and associates of Thomas A. Edison for the purpose of recounting and celebrating the achievements of a quarter of a century in the art of electric lighting, with which the name of Edison is imperishably identified. It was decided that the most effective means of accomplishing this object would be by the establishment of a gold medal, which should, during the centuries to come, serve as an honorable incentive to scientists, engineers and artisans to maintain by their works a high standard of accomplishment. The Edison Medal was, therefore, established

and endowed with a trust fund, under an indenture dated February 11, 1904, whereby the American Institute of Electrical Engineers agreed to award the medal annually. The medal is awarded each year by a committee consisting of twenty-four members of the Institute, to a resident of the United States of America and its dependencies, or of the Dominion of Canada, "For Meritorious Achievement in Electrical Science or Electrical Engineering or the Electrical Arts."

Ladies are cordially invited to attend this meeting.

TENTATIVE PROGRAM FOR AMERICAN INSTITUTE CONVENTION.

Three-day Meeting to Be Held at Atlantic City, Chiefly for Discussion of Power Engineering Problems.

The thirty-fourth annual convention of the American Institute of Electrical Engineers is to be held in the Marlborough-Blenheim Hotel, Atlantic City, N. J., June 26 to 28. It is expected that quite a large number of engineers will be present because of the importance of the topics to be discussed, these dealing chiefly with problems connected with the generation and transmission of electrical energy. The tentative program of papers and addresses is as follows:

Wednesday, 10:30 a. m.—Opening address by President E. W. Rice, Jr.; Reports of technical committee.

Wednesday, 2:30 p. m.—"Split-Conductor Cables—Balanced Protection," by William H. Cole; "Overhead Transmission Cables," by E. B. Meyer; "The Application of Theory and Practice to the Design of Transmission-Line Insulators," by G. I. Gilchrist.

Thursday, 10:30 a. m.—"Lightning-Arrester Spark Gaps," by C. T. Allcut; "The Oxide—Film Lightning Arrester," by C. P. Steinmetz; "Design of Transpositions for Parallel Telephone and Power Circuits," by H. S. Osborne.

Thursday, 2:30 p. m.—Conference of section delegates.

Thursday, 8:30 p. m.—"Fixation of Nitrogen," by E. Kilburn Scott; "America's Power Supply," by C. P. Steinmetz.

Friday, 10:30 a. m.—"Precharged Condensers," by V. Karapetoff; "Method of Symmetrical Co-ordinates Applied for the Solution of Polyphase Networks," by C. L. Fortescue; "Flux Distribution in Alternators Under Sustained Short-Circuit Conditions and Different Loads," by N. S. Diamant.

Friday, 2:30 p. m.—"Protection from Flashing in Direct-Current Apparatus," by J. J. Linebaugh and J. L. Burham; "The Automatic Hydroelectric Plant," by J. M. Drabelle and L. B. Barnett.

ELECTRIC WELDING TESTS BEING MADE BY EMERGENCY FLEET CORPORATION.

Will Determine Relative Strength of Welded and Riveted Parts to Be Made.

Ship-welding tests being conducted by the Emergency Fleet Corporation, at the Federal shipbuilding plant, Newark, N. J., under direction of Arthur J. Mason, are explained, as to purpose and benefits, in a report by Mr. Mason to Charles Piez, vice-president of the corporation, from which we take the following:

Electric welding in its various phases has for years been employed in shipyards and in the arts, but the work has been confined to odd jobs and repairs. The proposal to extend its use to the major part of ship construction has met with approval from the shipbuilder. It remains for us through this large test to demonstrate its economy in time and money and its adequacy to build a staunch ship. The purpose of this test is to demonstrate these advantages. The test itself will take the form of building part of a hull at the Federal shipbuilding plant, Newark, N. J. It has been necessary to design a ship to suit the material available, without encroaching on that needed for the regular ship construction at the plant. The hull will have the outline, dimensions and strength conforming to the ships the Federal company is building. It has been thought best to conduct the work at a site apart from the shipways, so as not to interfere with that program.

A 10,000-ton ship, costing $2,000,000, now costs but $70,000 to rivet. It must be plain that if electric welding only promises to modify this amount no very substantial gain offers. Splendid benefits do offer themselves in the possible change in the whole regime of shipbuilding. Our test has in view abolishing, or greatly diminishing:

1. The railroad journey from rolling mill to fabricating plant, when the latter is not at the shipyard. 2. The template makers' work. 3. The markers' work. 4. The punching. 5. Much of the fitters' and bolters' work who flog and pull the pieces to fit on the ways. There lies in the above items an excellent likelihood to save a month's time in construction and a saving of no less than $40 a ton in the cost of steel structure, at least $100,000 a hull on a 10,000-ton vessel.

Briefly, the program is to assemble a hull rapidly by spot welding, tacking the ship together, much as a tailor bastes his work in assembling a suit of clothes. The structure then becomes a house favorable for work in all weather and at night in which the completion of the ship may go on.

After the material is thus assembled and fastened with spot welds, so that it is sufficiently strong to hold its shape, the work is completed by arc welding all seams to insure strength and render the work watertight. Roughly, we expect the spot welds to be about ten inches apart.

The preparation of the site is well under way; the pile driving has been about completed. The severe tests of strength contemplated needed 300 piles.

One-quarter of the structure will be riveted; the other three-fourths welded so that the tests of strength will afford a basis of comparison.

Electric welding offers a field for lightening a ship. In this design various views of this opportunity will be tried out. The field here is very great—ultimately 10 per cent of the steel may be eliminated.

A sketch was prepared showing the work proposed. One derrick will bring material, the other derrick support the spot welding yoke, whose function is to tack the material together, fastening the plates either to the frames or to the adjoining plates.

Eliminates Time Waste.

If one visits the ways at any shipyard it becomes obvious that at any instant only a modicum of the men are for the moment at work. This is unavoidable under the present system. We hope to establish a plan of assembly with more continuity and less waiting on one another.

Only a fifth of the men on a hull are riveters. The spot weld yoke will forthwith pull the parts to

place with a much more vigorous agency than flogging and pulling to place by numerous bolts, now done by the other four-fifths.

The problems of fitting in place the parts of a hull are almost wholly problems arising out of the necessity to make a number of little holes in a plate made by one man at one time and place, fit a number of little holes made by another man at another time and place.

Once all holes are left out of the material, all parts fit. The creeping and kindred problems so perplexing to the shipbuilder disappear. Every plate becomes a closer. Every plate justifies itself.

The manufacture of the spot welding yoke and appliances is placed in the hands of the Universal Electric Welding Company of Long Island City. The design of the yoke is completed, the patterns made and steel castings will be forthcoming at once. The early stages of the arc welding are to be accomplished by the Wilson Electric Company, which was so successful in the work on the German ships' repairs, but it is the intention to call in all men with ideas and apparatus and to give them a field to test out in actual work.

ALL AVAILABLE TALENT SOUGHT.

To this end, Prof. Adams' committee is searching out all available talent. An adequate system of testing the work when done is under consideration. The primary test will consist of filling the hull with water and shifting the points of support under continual and close scrutiny, as one quarter of the whole will be riveted in the normal manner. There will be always a gauge of comparison with that portion which is welded. Likewise, there will be a chance for comparison of the two forms when subjected to abuse, by bumping with rams and in various other ways.

CHICAGO ELECTRICAL CONTRACTORS HOLD ORGANIZATION MEETING.

An organization was effected of the electrical contractors of Chicago at a meeting held on the evening of May 8 to constitute the First District Association of the Illinois State Association of Electrical Contractors and Dealers. Addresses were made by E. A. Edkins, R. W. Poelma, J. N. Pierce, E. Kohler, G. A. Engelken, T. Cody and others. Mr. Edkins, who is in charge of the electric shops of the Commonwealth Edison Company, spoke of the opportunities there are for the contractor-dealer in the merchandising line. The four outlying shops of the Edison company last year did about 100 per cent more business than the preceding year, whereas the downtown electric shop of the company did an increased business of only about 20 per cent. This indicated that there is a need for electric shops in residence neighborhoods, and that electrical dealers who opened such shops should do an excellent business. Mr. Edkins also spoke of the importance of utilizing window space for attractive displays. If the display is made attractive it acts like a magnet to not only attract attention but also pull the passer-by into the store. Mr. Edkins also gave other valuable suggestions on the establishment of electric shops. He explained how in the electrical pioneer days it was necessary for the company to not only establish sale of electrical supplies but even to do wiring of houses gratis in order to get people to use electricity.

The other speakers also touched on the value of engaging in the electrical merchandising business and on the need for organizing along the lines of the Goodwin Plan. Petty differences that have divided the contractors heretofore must be forgotten and a strong organization built up to put the plan into effect. The resut of the meeting was the formal organization of the Chicago district association with the following officers: Chairman, R. W. Poelma; secretary, G. A. Engelken; treasurer, Thomas Cody.

INDUSTRIAL PLANT LIGHTING DISCUSSED BY ILLUMINATING ENGINEERS.

Protective Lighting and High-Intensity Industrial Lighting Discussed at New York Meeting of I. E. S.

At the meeting of the New York Section, Illuminating Engineering Society, held on the evening of May 9 two papers were presented dealing with the lighting of industrial plants. The first of these was entitled "Industrial Plant Protection," and was presented by Edmund Leigh, chief of plant protection, Military Intelligence Bureau, Washington, D. C. His paper took up a discussion of the fundamental requirements for plant protection and explained the formation of the bureau directed by Mr. Leigh which has rendered invaluable assistance to plant managers in protection of their establishments, especially by protective flood lighting. Bassett Jones, Jr., consulting engineer, New York City, presented a paper entitled, "An Instance of Industrial Lighting." This described a unique installation of high light utilization.

SUBMARINE ENGINEER OFFICERS WANTED IN THE NAVY.

The Navy is in need of professional engineers for submarine duty, not over 35 years old and physically strong. The qualifications include: citizenship in the United States, the degree of mechanical, electrical or mining engineer from a university of recognized technical standing, and at least two and one-half years practical engineering experience.

The candidates selected will be commissioned ensign in the U. S. Naval Reserve Force, and be sent to the U. S. Naval Academy and to the Submarine School in New London for a special technical course. Engineers subject to the Selective Draft law and those now in the Army are eligible. Letters from at least three responsible personal acquaintances must accompany each application.

Applications may be addressed to the American Engineering Service of the Engineering Council, Room 903, 29 West 39th Street, New York City.

LIGHT AND POWER PLANT FOR MONTEREY, INDIANA.

Monterey, Indiana, some time ago granted a franchise to the Monterey Light & Power Company to supply electric light and power for the city. This company is controlled by W. A. Beile & Company, Chicago, who have established an office at Monterey. Plans have been made, and equipment ordered, for a power plant, construction work on which is to begin as soon as deliveries of material and machinery can be made. The plans provide for the installation of two Westinghouse generators, to be driven by Fairbanks-Morse oil engines. The franchise includes the building and operation of waterworks, plans for which have not been made as yet.

Commercial

Rapid Progress of Industrial Heating—War Problems of the Utilities—Electricity as Food and Coal Economizer

GROWTH OF INDUSTRIAL HEATING IN CHICAGO.

Census of Industrial Heating Loads in Chicago Shows Increase in Numbers and Uses.

A census of industrial heating devices connected to the Commonwealth Edison Company's system on April 1, 1918, shows that in the last eight months, since August 1, 1917, the industrial heating load has increased by 2918 appliances representing an additional load of 4791 kilowatts, and making a total connected load of 43,030 kilowatts. Moreover, there are eight additional applications, compared with the previous census. The accompanying table shows the number of appliances connected to the Commonwealth Edison Company's system, their purpose, and load represented by them as of April 1, 1918. The appliances connected on August 1, 1917, and July 1, 1916, are also given for purposes of reference.

This table shows that whereas during the thirteen months, ending August 1, 1917, there were developed two new applications, during the period between August, 1917, and April, 1918, there have been eight new applications, making today 58 different applications of industrial heating. There are actually more than this, but many of them are war-time applications, description of which must for the present be foregone. In a future issue of the ELECTRICAL REVIEW more than thirty new applications of industrial heating that have been connected within the last few months in Chicago will be described by A. F. Allsop, industrial heating engineer, Commonwealth Edison Company.

While the number of appliances have increased by 2918, and the connected load by 4791 kilowatts, during the last 8 months as compared with the high gain during the previous period of thirteen months of 14,382 kilowatts, the latter was composed of 11,320 kilowatts due to large furnaces, whereas during the last eight months only 2720 were gained in this way. In other words, neglecting large arc furnaces, the increase in connected load for the last 8 months has been 2071 kilowatts compared with 3062 for previous 13 months.

Not all new developments are due to the war, although it is very probable that the war and the conditions it has imposed, have exerted a powerful influence. For example, the corset-ironing machines, the macaroni machine heaters, and the envelop dryers are peaceful processes but it has been the necessity of doing faster work with less labor and perhaps at lower cost that have encouraged the electric heater. So also with the oil heaters. The war has caused a shortage of cars and congestion of tracks. The oil heater when submerged in a tank car during very cold weather enables a tank car to be emptied in a fraction of the time otherwise required, hence their use while saving demurrage charges at the same time performs a patriotic purpose. The shortage of labor and the higher wages being paid today have forced employers to realize that lost time and motion and delays are often the cause of turning profit to loss. The electric heater or dryer, perhaps one to each individual operative, may permit of more rapid work, less delay and fewer complaints about unpleasant conditions. And then there are other reasons, as lower fire hazards, insurance rates, less material wasted, or better results than could have been otherwise obtained.

There are, in addition to those appliances that have come on account of economic conditions, some that are due to the benefits of electric heating becoming better known. For example, three tower water tank heaters were installed during the present winter to prevent the freezing of water in water towers. And so it goes. Electrical heating may not be the cheapest mode of heating, when considering the cost of heat only. But it often is the cheapest, as the accompanying table of increased uses and numbers of appliances testifies, when considering the cost of labor, the expenditure of time and material, and so forth.

INDUSTRIAL HEATING APPLIANCES IN CHICAGO.

Device.	1916		1917		1918	
	No.	Kw.	No.	Kw.	No.	Kw.
Annealing furnaces	.....	.....	4	240	4	240
Air heaters (industrial)	40	46	156	161	178	194
Aquarium heaters*	.....	.....	.....	.....	9	2
Baking installations	10	127	13	142	14	179
Bacteriological ovens	7	6	14	13	16	15
Branding irons	80	28	192	75	227	87
Beer-vat dryers	11	33	12	36	12	36
Corset ironing machines*	.....	.....	.....	.....	5	3
Can cappers	105	36	124	49	128	52
Commercial flatirons	25,000	17,000	25,850	17,610	26,850	18,510
Coffee urns (commercial)	9	14	22	35	29	41
Celluloid heaters*	.....	.....	.....	.....	14	16
Core baking ovens*	.....	.....	.....	.....	3	174
Disk stoves (industrial)	700	385	1,340	1,190	1,410	1,212
Drying ovens	7	18	38	101	44	128
Embossing presses	11	17	12	18	15	24
Enameling ovens	5	603	13	638	15	668
Envelope dryers*	.....	.....	.....	.....	5	6
Extract heaters	70	139	107	268	111	271
Film dryers	13	27	13	27	14	32
Furnaces (arc)	4	2,680	13	14,000	15	16,720
Furnaces (electrolytic)	.....	.....	6	240	6	240
Furnaces (resistance)	18	38	32	126	37	141
Glue pots	5,000	1,150	6,200	1,380	6,400	1,400
Glue cookers	15	72	17	81	19	88
Glue - heating installations (special)	54	37	88	67	95	82
Immersion coils (liquid heating)	150	170	215	202	220	238
Ink dryers	160	96	235	141	276	156
Linotype pots	21	36	24	38	25	41
Liquid-heating installations (special)	65	72	82	94	89	103
Macaroni machine heaters*	.....	.....	.....	.....	4	5
Metal-melting pots	5	11	6	16	36	146
Material heaters	36	57	62	118	75	123
Monotype pots	2	4	2	4	2	4
Oil heaters*	.....	.....	.....	.....	33	44
Printing-press dryers	7	11	7	11	8	14
Putty-warming machines	5	9	7	12	8	14
Pleating machines	6	7	9	11	9	11
Photo-print dryers	4	8	18	22	21	42
Pyrographic machines	5	29	5	29	5	29
Photo-chemical bath heaters	7	13	21	36	25	55
Popcorn machines	14	35	19	47	22	56
Roofing-machine heaters	4	29	5	36	5	36
Radiant heaters (industrial)	240	144	356	202	381	253
Sealing-wax heaters	200	40	278	59	287	68
Sterilizers	90	40	104	49	112	54
Soldering irons	750	150	920	192	1,170	243
Soldering-iron furnaces	30	18	35	49	36	50
Solder pots	9	5	15	8	21	12
Tempering ovens	2	9	19	91	23	115
Tempering baths	1	7	2	14	2	14
Toasters (commercial type)	27	82	68	206	80	244
Vulcanizers (industrial)	18	14	35	26	59	49
Varnish heaters (spraying)	175	105	335	185	345	192
Wax-knife heaters	34	9	43	12	45	13
Wax heaters	32	7	37	9	41	10
Waffle irons (commercial type)	12	12	23	23	26	26
Water tank heaters (tower)*	.....	.....	.....	.....	3	9
	33,270	23,857	36,251	38,239	39,169	43,030

*New appliances.

THE WAR AND THE PROBLEMS OF THE UTILITIES.

Max Thelen, of California Railroad Commission, Places Utility Problems in Clear Light.

In an address recently delivered by Max Thelen, president of the Railroad Commission of California, some of the war-time problems of public utilities were discussed in clear light. He gave especial consideration to street railway, electric, gas, and water companies, taking up the subjects of rates, service, extensions and finances, and made suggestions as to the duties of state commissions relating thereto.

He cited the fact that the California Commission had received 106 applications for rate increases within the last year; of these, ten were from electric power companies. Among these were the applications of the Pacific Gas & Electric Company and Great Western Power Company for authority to increase rates in the entire territory served by them. Realizing that, as the result of large increases in costs of operating, some of the public utilities had suffered severely, he said their ability to continue rendering adequate service would be seriously impaired unless authority to increase rates were promptly granted. The Commission, he said, did not hesitate to meet an emergency by applying short cut measures, instead of adopting the usual routine that involves unreasonable delay. The Commission is keeping in mind the importance of maintaining all these utilities at their maximum efficiency during the war. Public utilities should not expect an increase in profits during the war, and Mr. Thelen states that in accordance with this principle the utility companies asking for an increase in rates have announced that they would be content with the same net return as were received prior to the period of increased costs.

One of the most pertinent statements contained in Mr. Thelen's address was the following:

"The State Commissions should not wait until utilities come to them with their pleas for assistance. It is their duty to inform themselves by their own investigations, if necessary, concerning the condition of the public utilities under their jurisdiction, and to keep themselves constantly informed.

It was asserted that, in those localities where war-work demands for electric energy are exceeding the producing capacity of the utilities, it will be necessary to establish priorities of use, curtailing or eliminating those uses least essential from the standpoint of the nation's war requirements. This problem, it is stated, has been practically solved in California through a conference between Federal and State authorities and the several electric companies concerned.

On the subject of extensions, the California Commission purposely carefully scrutinizes extensions involving large expenditures to determine how they synchronize with the nation's war requirements. Extensions to carry out increased hydroelectric development, however, are deemed essential in enabling the state to do its part in war work, and the increase of every kilowatt possible is urged.

An additional 8000 kilowatts of energy from the northern section of the state has been made available to the Pacific Gas & Electric Company at Calusa; this was accomplished by combined action on the part of the California-Oregon Power Company, the Northern California Power Company and Pacific Gas & Electric Company. Other similar arrangements have been made for increases and an effective distribution of power in that state.

ELECTRICITY THE FOOD AND COAL ECONOMIZER.

Though the rationing of electricity supply works in respect of fuel and of consumers in respect of energy consumption, is a strongly adverse factor in many districts in England, there are some places where the authority is able to take advantage of the present food and coal situation for boosting electric cooking as a direct saver of both coal and food. Probably there never was a time when educational seed concerning domestic electricity could fall into a more fertile soil than that prepared for it by current conditions.

The Stowmarket Electricity Company has brought the advantages of electric cooking before its customers in a striking manner. This utility circulated a circular upon which was printed at the top in bold type, "SAVE COAL — COOK BY ELECTRICITY — SAVE MEAT." Then followed some interesting and striking data as to the value of electricity as the cooking medium for saving coal and meat.

One instance given was that of a lady doing her own cooking for a family of ten. The effect of cooking with coal and electricity was found to be as follows:

Cooking with coal, June, 1915, to June, 1916	4.75 tons
Cooking with electricity, June, 1916, to June, 1917, coal required at central station	1.75 tons
Saving of coal, due electric cooking	63 per cent

In another instance the cooking was in the hands of a kitchen staff, and the family had seven members. The following results were obtained:

Coal required for kitchen range and servants' hall.	20.85 tons
Cooking electrically, coal required at central station	4.45 tons
Coal required by servants' kitchen	3.00 tons
	7.45 tons
Saving of coal, due electric cooking	64 per cent

An example of tests carried out at a hotel demonstrates the saving of meat accruing from electric cooking:

	Lb.	Oz.
Top-side of beef cooked in coal-fired oven—		
Weight of meat before cooking	19	15
Weight of tin and grid	3	5½
	23	4½
Weight after cooking	16	10½
Loss, 33.2 per cent	6	10
	Lb.	Oz.
Top-side of beef cooked in "Lightning" Electric oven—		
Weight of meat before cooking	23	10½
Weight of tin and grid	2	5½
	26	5
Weight after cooking	25	5½
Loss, 4.1 per cent		15½

Current used for cooking, 2.897 kilowatt hours.

It will be seen that if the family of ten, first referred to, cook 7½ lbs. of beef each week the saving in meat would amount to more than 113 pounds in a year in addition to the 3 tons (long) of coal saved. The saving of 113 pounds of meat at 40 cents amounts to $45.20 and will more than pay for the electric oven. Mutton does not waste so much as beef in cooking by coal-fired oven, but again electricity shows a saving of over ten per cent.

By adopting electricity for cooking it is possible to save the nation's coal, food and man power, get a larger meat ration and reduce labor in the house.

SELLS 535 CLEANERS IN MONTH.

The Denver (Colo.) Gas & Electric Light Company completed its month's Hoover sweeper campaign on April 20. The number of machines sold totaled 535 with a value of $31,489. This was an increase of 25 machines and $1,593 over last fall's campaign.

Operating

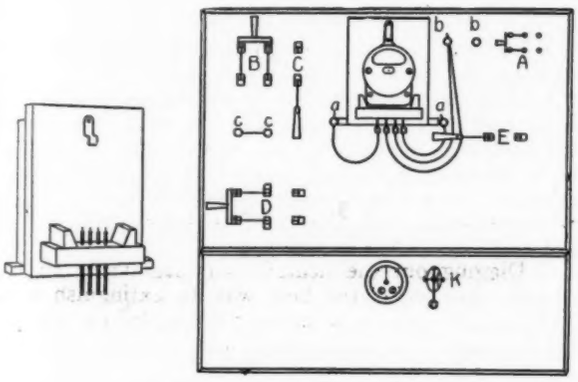
A Single-Phase Meter Test Board—Determining Phase Rotation Simply—Handling Fires in Bituminous Coal Piles

A SINGLE-PHASE METER TEST BOARD.

By W. R. Frampton,
Superintendent, Meter & Test Department, Southern California Edison Company.

A short method has been devised by the Testing Department of the Southern California Edison Company which has been in service for several years for testing meters in the laboratory.

The accompanying illustration shows the assembly of this meter test board which is mounted on a regular meter testing panel. The board is hung in place in the following manner: A bolt, properly designed, sticks out from the panel board and the meter test block is hung on with a piece of brass on the back of the board, slotted, allowing it to slip in place. This special panel, as shown, is made to fit bottom-connected meters, although a scheme for side connected meters which is similar in operation to the above has also been devised.



Single-Phase Meter Test Board.

The meter is set on the block where four brass terminals stick out vertically. These terminals have a spring tension inside the block and the weight of the meter will force them down nearly flush with the block which gives excellent contact.

The various details of the test board are as follows:

A—Potential switch. Left, 100% power-factor. Right, 50% power-factor.
B—Current switch.
C—Short-circuiting switch for meter on test.
D—Load switch. Left, heavy load. Right, light load.
E—Short-circuiting switch for test meter.
K—Key.
a, a—Current terminals.
b, b—Potential terminals.
c, c—Terminals for connecting ammeter in circuit for measuring current passing through meter on test.

The lower panel containing the test meter and key is horizontal and at right angles to the panel board.

A swivel catch is to be noticed at the top of the meter board. This swivel catch can be moved either to the right or to the left with the finger, and after the meter is set in the block, this swivel catch is brought down over the top hanger of the meter holding it in place.

It has been said that testing meters in bank is more quickly done than testing one at a time. On comparison of the method of testing with our meter block, it is found, however, much faster to test meters in this manner, as no wires have to be connected or disconnected and just one movement made, namely, that of letting the swivel catch drop over the top hanger of the meter.

A board similar to the one described above can be designed for almost any type of meter and a great deal of saving in testing can be attained in this way.

The accompanying illustration shows the details of the different switches connected to the meter; also the location of the standard test meter in the lower panel with the potential switch key.

A SIMPLE METHOD OF DETERMINING PHASE ROTATION.

Method Employed by University of Wisconsin by Use of Lamps and Inductance.

In testing watthour meters at low power-factor, a 50 per cent power-factor may be conveniently obtained in those cases where a three-phase system is available by connecting the current coil of the meter through a suitable load rheostat to one phase and the potential circuit of the meter to an adjacent phase, as the power-factor will then be 50 per cent leading or 50 per cent

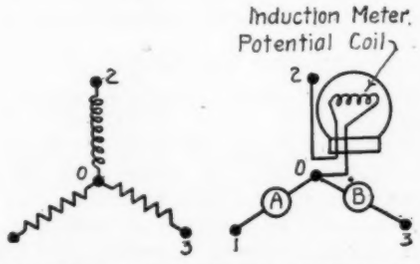


Fig. 1.—Connection of Wattmeter for Obtaining Lagging or Lagging Power-Factor of 50 Per Cent.

lagging, depending upon which adjacent phase is used. A knowledge of the direction of phase rotation is therefore necessary in order that a lagging power-factor connection may be made.

A simple and convenient method of determining the direction of phase rotation (requiring the use of only such equipment as may usually be found in the field) consists in connecting two similar electric incandescent lamps (equal non-inductive resistances) and the potential circuit of an induction type watthour meter (inductance) in star to the terminals of the three-phase system, as illustrated in Fig. 1. The two lamps will then operate at different brightnesses, due to un-

equal voltage distribution as shown above, lamp B being brighter than lamp A, when the direction of phase rotation is 3—2—1, or vice versa. Thus a 50 per cent lagging power-factor (where the current lags the voltage by 60 degrees) may then be obtained, for example, by connecting the current circuit across phase

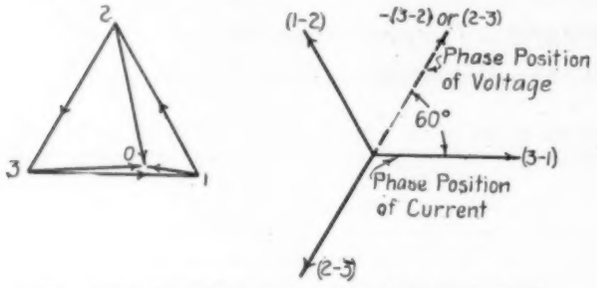


Fig. 2.—Vector Diagram Showing Voltage Relations.

(3—1) and the voltage circuit across phase (2—3). This is shown by the vector diagrams in Fig. 2.

As a simple rule of thumb, it may be remembered that 50 per cent lagging power-factor is obtained by connecting the current coil or load circuit to the phase terminals to which are connected the two lamps, and the voltage circuit to the phase terminals to which are connected the bright lamp and the meter coil.

HANDLING OF FIRES IN BITUMINOUS COAL PILES.

Methods of Watching Heating in Coal Piles, and Modes of Extinguishing Fires.

The slogan of "Buy Your Coal Now," and the zoning method of coal distribution is increasing the amount of coal stored and the number of consumers storing it. The zone method of distribution, likewise, is increasing the possibility of fires occurring in piles of stored bituminous coal. Some interesting facts were brought out by H. H. Stoek, professor of mining, University of Illinois, in his recent paper read before the Western Society of Engineers entitled, "The Storage of Bituminous Coal," dealing with fires in coal piles and methods of handling them when they do occur.

Testing for Heating.

The common methods for the testing of heating coal piles are:

1. Watching when the pile begins to steam.
2. The odor, which is either that of burning bituminous matter or burning sulphur.
3. By means of an iron rod inserted into the pile and when drawn out tested by feeling with the hand.
4. By means of the thermometer inserted into a pipe driven into the pile.
5. By spots of melted snow, applicable only seasonally.

The best preventive of loss in coal storage is to regularly inspect the pile and if heating occurs up to 150 degrees Fahrenheit to keep very close watch on the pile and if the heating increases, to 175 or 180 degrees, to remove the coal as promptly as possible from the spot affected, and thoroughly cool it before piling again. Storage appliances and arrangements should be so designed so as to make it possible to load out the coal quickly if necessary, and the coal should not be stored in large piles unless provision is made for loading it out quickly. Pieces of wood, greasy waste, or other easily combustible material mixed in a coal pile may form a starting point for a fire, and every effort should be made to keep such material from the coal as it is being put in storage. It is very important that coal in storage should be kept from such external sources of heating as steam piles, because the susceptibility of coal to spontaneous combustion increases rapidly with an increase in temperature.

Opinions differ widely in regard to when the temperature reaches a critical or danger point. Parr says, "Bituminous coal can be stocked without appreciable loss of heat value provided the temperature is not allowed to rise above 180° F. How close to this temperature a pile should be allowed to heat is largely a matter of judgment of those in charge of a heating pile, for if the rise in temperature seems to be decreasing rather rapidly, it may be safe to allow it to approach the 180° point, but if the rise is steady and regular, it is wise to load out the pile before the danger point is reached. This rise also depends upon the means available for loading out, for at a plant equipped with large grab buckets and means for rapidly handling the coal a higher temperature can be permitted than when considerable time may be required to load out the coal. A person in charge of a certain kind of coal under certain climate conditions will soon learn what is the danger point and it is impossible to set any critical temperature that will apply to all coals under varying storage conditions. The only safe rule is to watch the temperature closely and get ready to load out when the temperature reaches 150° and to move the coal if the temperature reaches 175°.

Handling of Fires.

Water has generally not proved effective in putting out fires, due, no doubt, to the fact that often it cannot be applied or is not applied in sufficient quantities to thoroughly cool the entire mass. It is the very general opinion that excepting for quite small piles which can be completely soaked, water will aggravate rather than put out a fire. Water frequently cannot reach the fire because of a layer of coke that has formed a protection about it.

Digging out the heated coal, preferably by locomotive cranes, is the best way to extinguish a fire. The fire can, also, be restricted by playing water on the burning surface while digging out the burning portion of the pile.

W. L. Abbott, chief engineer, Commonwealth Edison Company, who has long experience with all varieties of Illinois coal in storage for long periods, has said:

"Nearly any coal which has gone over a 1½-inch screen can be stored." "Any size of coal with duff left in will heat."

"Pea coal (over ½-inch through ¾-inch) has been in storage for more than a year without heating. Coal with screenings removed has been kept in storage 8 years without firing."

A USE FOR DISCARDED TRANSIL OIL.

Although it usually pays to renovate dirty transil oil for further use, it sometimes happens that oil is so charged with foreign matter, sawdust, carbon from burnt-out transformer windings, etc., that it is thought hardly financially worth while to attempt to renovate it. One company whose practice it is to renovate all its transil oil has found it not worth doing so in some cases, but instead of throwing the oil out sells it for cash to the local gas company for enriching illuminating gas.

Contracting-Construction

Croft Discusses Timber Conduit-Bending Racks—Substitute for Leatherheads—Doings of Electrical Contractors

SOME COMMENTS ON CONDUIT BENDERS.

Bending Racks Made of Timbers Can Be Easily Built for Handling the Larger Conduits.

BY TERRELL CROFT.

[*This is the third of a series of articles describing different types of conduit benders and commenting on their use. These articles form a very suitable sequel to the seven articles on "Methods of Bending Conduit," by the same author, which appeared in the* ELECTRICAL REVIEW *of January 12 to February 23, 1918, inclusive.*]

A Bending Rack for Large Conduits is shown assembled in Fig. 14, while Figs. 15 and 16 illustrate details of its construction. Fig. 14 is the same as Fig. 2 and is reproduced here for the sake of convenience. The essential members are two longitudinal timbers *G* and *G* (Fig. 14), which should, for heavy work, be at least 6 inches square. Across the longitudinal pieces are bolted two fixed pieces *F* and *T* each about 6 inches square and a couple of feet long. A movable timber *M* (see Fig. 16 for detail) with a groove cut in it for the conduit, is arranged to slide longitudinally on the rack.

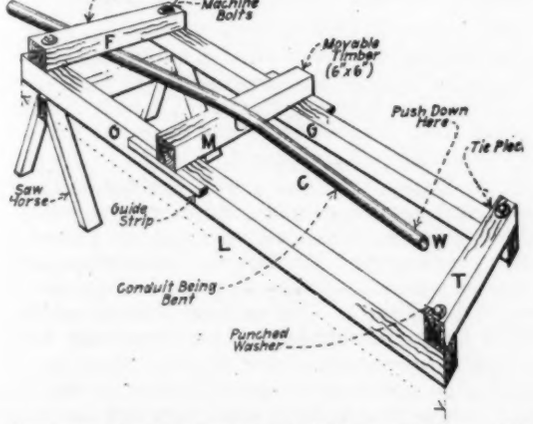


Fig. 14.—Large Bending Rack Built of Heavy Timbers. (Same as Fig. 2.)

When in use, one end of the rack is elevated on a box, frame or saw-horse as suggested in the illustration (Fig. 14). In bending the tube, one end is placed under the timber *F*, and *M* is shifted to the most desirable position. Then the mechanic throws his weight on the other end of the tube *W* which will produce a bend in the conduit. A bend cannot ordinarily be made with one setting of *M*. It is, on the contrary, necessary to do the thing by degrees. That is, with one setting of *M* the tube is partially bent; then *M* is shifted backwards or forwards as may be required and the tube bent further. This process is continued until the desired contour has been obtained.

The movable timber *M* should have the slot, which is cut in it for the conduit, rounded as detailed in Fig. 16 because, if this procedure is not followed, there is a possibility of introducing kinks or wrinkles into the conduit. For the best work, the width and the radius of the slot should be such that the conduit fits into it nicely. Hence, it follows that it is desirable to have a separate movable timber with a groove of different diameter for each size of duct. Or, instead, a number of different grooves of different sizes may be cut in

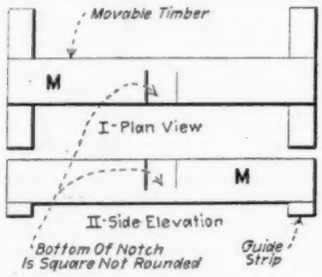


Fig. 15.—Showing the Simplest, but Not the Best, Method of Cutting the Notch for Conduit in a Bending Rack.

the same movable timber to accommodate tubes of different diameters. However, a skilled workman can operate successfully on conduits of a number of different diameters by using a groove of but one size. The groove should also be rounded as shown in Fig. 16 and should never, except for the roughest sort of work, be cut square as shown in Fig. 15.

An Improvised Bending Rack (Fig. 17) can be assembled on any job where it is necessary to bend a few medium or large-size conduits. The raised end may, as suggested in Fig. 17, be supported on a window sill or on a pile of brick, rock or other building material. This device comprises merely two principal timbers P_1 and P_2 and a couple of blocks B_2 and B_3, arranged across them as indicated. It is usually desirable to nail a third piece B_1 across their upper ends to prevent the timbers from spreading apart. The procedure in making a bend with this device is essentially the same as that described in the preceding paragraph.

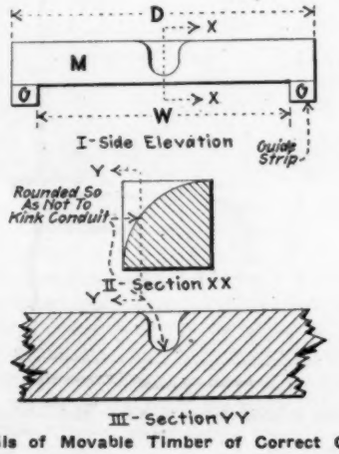


Fig. 16.—Details of Movable Timber of Correct Construction.

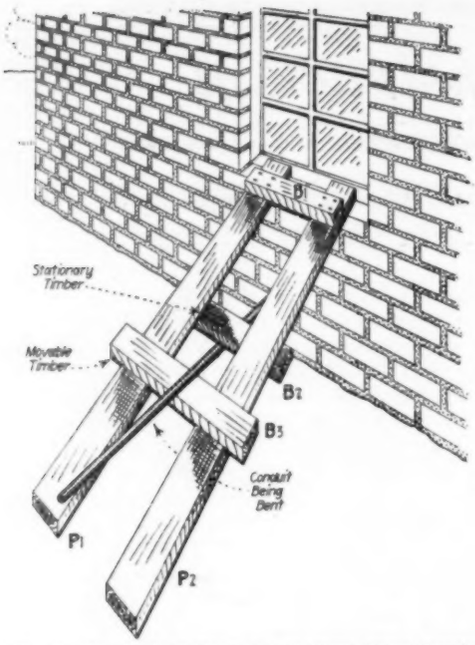


Fig. 17.—An Improvised Rack for Medium-Sized Conduits.

A Bending Rack Comprising a Timber Braced Between a Ceiling and the Floor is shown in Fig. 18. This arrangement is another which can be utilized to advantage where a few relatively heavy conduits are to be bent and a bending machine is not available. It comprises a length of timber *T* 6 inches by 6 inches or 8 inches by 8 inches in cross section, through which is cut a hole *H* large enough to admit the conduit. The timber is clamped between the floor and the ceiling, of the building in which the conduit installation is to be made, with a wooden wedge *W*, as indicated in the illustration.

In bending, the conduit is, as shown, gripped in the hole, which should be large enough to accommodate the largest tube used on the job. If ducts of the smaller diameters are to be bent, a wooden block can be placed in the bottom of the hole, *H*, thus reducing its effective size. It may be found economical to make a timber, such as that shown at T, of oak so that it will give continuous service under the severe usage

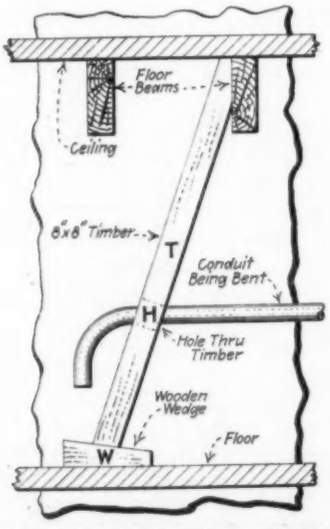


Fig. 18.—Timber Braced Between Floor and Ceiling for a Bending Rack.

which it receives. Such an oak timber may be carried from job to job and will last a considerable time. In order to secure sufficient leverage it may be necessary to push a length of conduit, of a diameter larger than that which is being bent, over the piece being formed, thus providing a long handle. In bending the tube, a considerable portion of the bend is formed on one side of the timber and then the bend is finished by moving to the other side. Two men pushing down on the end of the duct are usually necessary.

(To be continued.)

LEAD WASHERS INSTEAD OF LEATHERHEADS FOR NAILS.

By A. S. Miller.

Certain cases have been reported where lead washers were used under nail heads for supporting knobs and cleats. It has been claimed that they can be put on much more quickly than leatherheads and that they are not affected by the weather. For the 8-penny nails used for cleats and the 10-penny nails used for knobs, the lead roofing washers have been applied. Inasmuch as these are not very thick, it has been suggested that it is better to use two washers under the head of each nail. The washers cost about 12 cents a pound.

AMONG THE CONTRACTORS.

W. A. Beile & Company, Association Building, Chicago, are wiring the Mid-City Bank Building of this city. This is an eight-story building which is being rebuilt as a concrete structure. The wiring, which is all in conduit, extends to the basement to provide lighting for the safety-deposit vaults of the bank.

The Arrow Electric Company, Seattle, Wash., is overhauling the electrical equipment in the six-story Howard D. Thomas Building at 2000 Fifth Avenue for the Saxony Knitting Company, which is moving its plant from First Avenue and Jackson Street and greatly enlarging its equipment.

F. A. Darby, who has a well-established business in electrical appliances and fixtures at Evanston, Ill., sold about 400 machines last year and has a good start on this year's trade. He does no contracting and specializes on washers, vacuum cleaners, ironers and other household utilities. This enables him to widen his field of merchandising beyond his immediate locality.

Harloff-Loprich Electric Company, Madison, Wis., moved this spring into new quarters at 602 State Street, where 500 visitors were received on opening day. A contract recently put through was the wiring of the residence of Dr. J. A. Jackson that cost $40,000; the new residence of Dr. F. A. Davis, costing about the same amount, was also wired. Both jobs were conduit installations; the contracts included putting up fixtures. Each contract amounted to $1500.

R. J. Nickles Electrical Company, Madison, Wis., is putting through the electrical work on the new Y. M. C. A. building in that city. This consists of wiring for 400 outlets for lighting and some power. The building consists of a reinforced-concrete frame structure, with interior walls of hollow tile and exterior walls of brick. The building is costing about $150,000, and the electrical work amounts to $5000. This concern also has in hand the electrical work on the Beecroft Theater for moving-picture exhibits. The job includes putting in a Martin rotary converter to produce direct current for a 7½-kilowatt outfit.

Contractor-Dealer

Service by the Dealer—Guaranties on Appliances—Fine Appliance Display—Trade Acceptances—New Uses of Fans

COMMENT BY A SUCCESSFUL DEALER ON SERVICE.

W. J. Ball, manager of Tri-City Electric Company, Moline, Ill., and Davenport, Iowa, in discussing the sale of lamps and other appliances, is quoted as follows:

"We have progressed, not especially because we believe our lamps to be better than many others, but because we have sold service with lamps. The public willingly pays for service. It may not always be in dollars, however; it may be in willingness to go a little farther in the assurance of getting what is wanted. We have what the public wants and make this fact known. Last summer we found we were just a little farther from the main business district than the public wanted to go for service.

"We could not and would not offer inducement by cutting the price of lamps, so we moved to the middle of the retail district, into a new building, especially arranged for us and also occupied by the lighting company. Their advertising helps us sell our wares, while our advertising of labor-saving devices helps them sell current. We are for the Goodwin Plan of co-operation."

WHAT SHOULD BE THE DEALERS RESPONSIBILITY IN MANUFACTURERS' GUARANTIES?

Washing machines and vacuum cleaners are often sold under the strong guaranties of the manufacturers, and the dealer who sells to the user is sometimes harassed by requests from the customer to keep the machine in order. The guaranty is construed to mean that the machine or appliance is to be kept in repair. The dealer stands between the customer and the manufacturer and bears the expense of time and work in trying to render satisfaction. The most of the complaints are of a kind that the dealer cannot put up to the manufacturer because they do not come within the scope of his guaranty. This whole matter gives rise to the need of placing before the buyer a definite outline of what is guaranteed and what isn't; and this should be done before the customer buys, rather than afterward. A defect in an appliance gives the customer the right to return it to the dealer and by him to the manufacturer. But the supplying of new parts and keeping up repairs are risks a buyer assumes in the purchase of any kind of equipment.

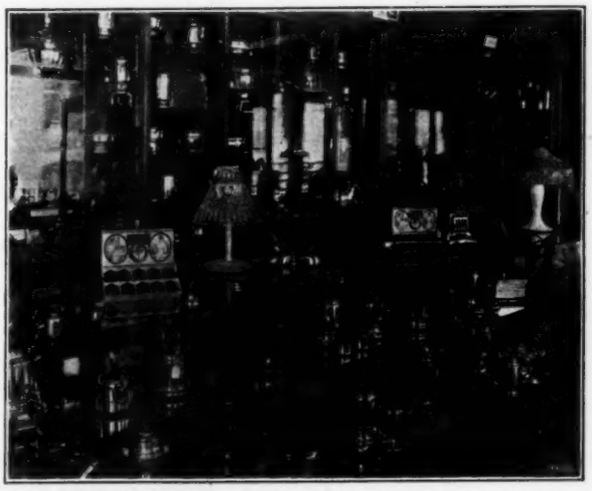
OPPORTUNITIES IN MOTOR REPAIRING AND REBUILDING.

The possibilities of a profitable business in operating an electrical repair shop are illustrated by the Wisconsin Foundry & Machine Company at Madison. This concern is successor to the old Northern Electric Company, a pioneer in electrical work. Since 1910 the existing company has developed a good business in repairing motors and other equipment for street railways, mines and paper mills. It finds ready access to the lead and zinc mines of southern Wisconsin, the paper mills on Fox and Wisconsin Rivers, and for various electric railways. Both direct and alternating-current motors are rewound, and in many cases discarded motors are rebuilt and placed on the market. The mine operators furnish an important part of the repair business, as they use motors for operating hoists, mine pumps, concentrators and mechanical roasters. Demands for power, and consequently for motors, are increasing in those mining districts by reason of the fact that high-priced metals make low-grade ores profitable to work. One phase of the industry is extracting the sulphur from the low-grade sulphide ores. Work received at this shop from the paper mills is mostly in the line of reconstruction of motors required as individual drive for various machines.

This concern keeps a force of seven men on motor repairing and rebuilding, and a force on special work.

A DISPLAY OF HIGHLY FINISHED GOODS.

A view of a corner in Julius Andrae & Sons Company's electrical appliance store, Milwaukee, is reproduced herewith. It represents a display of highly finished electrical utensils and appliances within a glass-inclosed counter and on shelving protected by glass doors. The glass inclosures are for protection only, and are not provided with the idea that customers must see them only through glass covers. Buyers, of course, are offered an opportunity to inspect and handle such merchandise which may be taken out of the cases for that purpose. This is a view of only one of the many attractive features of this well-arranged store.



An Attractive Corner of Julius Andrae & Sons Company's Appliance Store, Milwaukee.

Application of Trade Acceptances to Electrical Industry

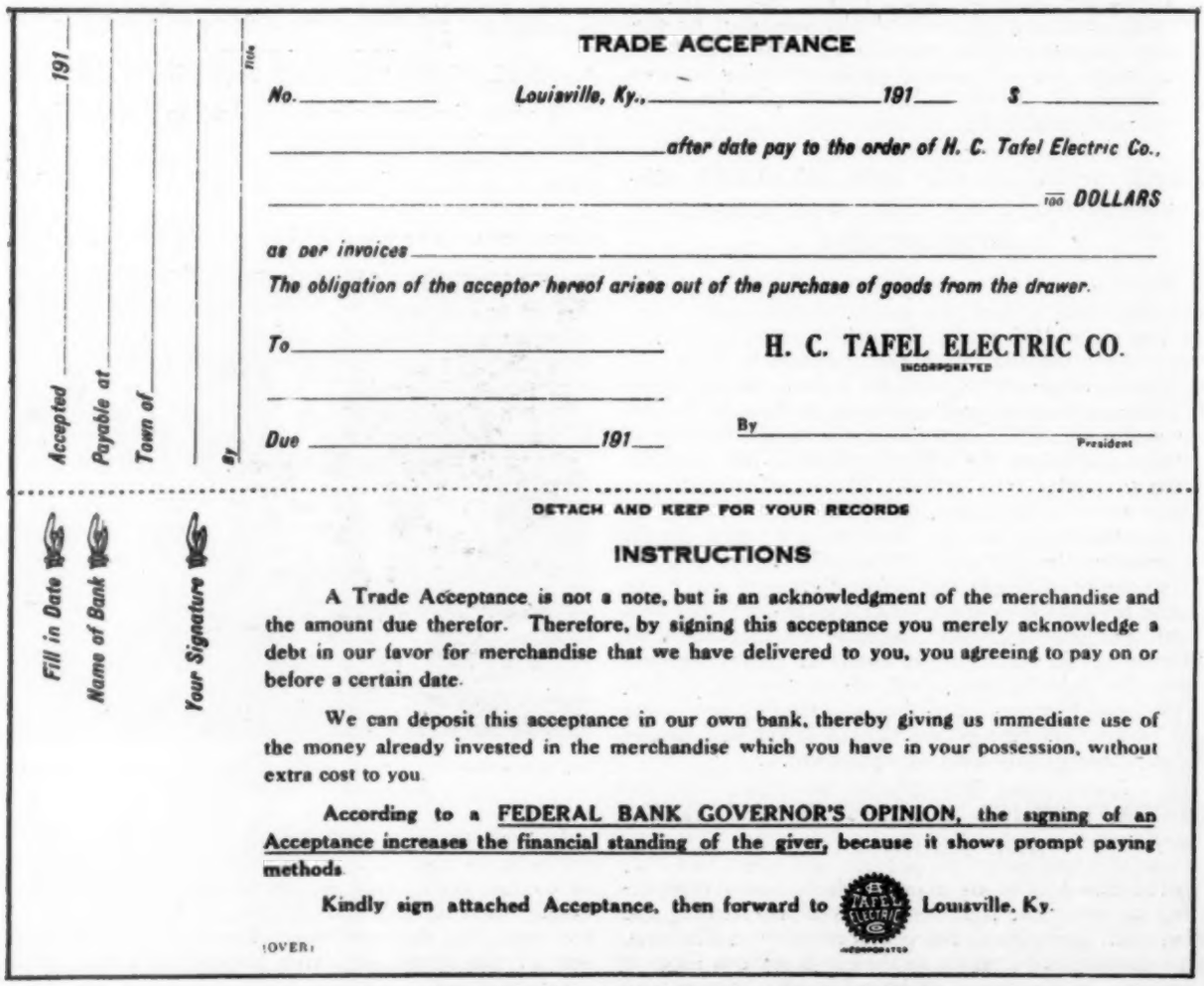
Many Representative Manufacturers and Jobbers Adopting New Method—How It Affects Contractors and Dealers

THE H. C. Tafel Electric Company, jobber and retail dealer in electrical appliances and supplies, Louisville, Ky., was among the first in the electrical industry to introduce and develop among its customers the Trade Acceptance plan of handling credits. This method of settling accounts in merchandising transactions, while by no means new, is coming into use as the result of the establishment of the Federal Reserve Banks in the United States, one of the functions of which is to accept this class of commercial paper based upon the actual sale and transfer of merchandise.

The trade acceptance is an acknowledgment of indebtedness for merchandise purchased and received; further, it is the acceptance of a draft for the amount due for such merchandise, payable in a stated number of days after date of purchase. The form adopted by H. C. Tafel Electric Company, reproduced herewith, is clear and self-explanatory.

It is well to note herein the difference between the trade acceptance and the ordinary commercial draft. The former represents the indebtedness involved in the transfer of goods, in which the transfer and indebtedness are acknowledged; the latter may not represent any specified transaction, but as a matter of practice often covers an indebtedness for several transactions not specified, and may be to cover past due accounts for goods purchased at different times, borrowed money or other obligations. The trade acceptance is, however, in the nature of a draft drawn by the seller on the purchaser of goods and accepted by the latter; in this the amount of the purchase and the date of payment are given.

The effect of the trade acceptance is to put in existence a volume of commercial paper that serves as the basis for the issuance of additional currency by the Federal Reserve Banks, thus making the volume of currency flexible in response to the demands of



TRADE ACCEPTANCE

No. _____ Louisville, Ky., _____ 191__ $ _____

_____ after date pay to the order of H. C. Tafel Electric Co.,

_____ 100 DOLLARS

as per invoices _____

The obligation of the acceptor hereof arises out of the purchase of goods from the drawer.

To _____

_____

Due _____ 191__

H. C. TAFEL ELECTRIC CO.
INCORPORATED

By _____
President

Accepted _____ 191__
Payable at _____
Town of _____
By _____
Title

DETACH AND KEEP FOR YOUR RECORDS

Fill in Date
Name of Bank
Your Signature

INSTRUCTIONS

A Trade Acceptance is not a note, but is an acknowledgment of the merchandise and the amount due therefor. Therefore, by signing this acceptance you merely acknowledge a debt in our favor for merchandise that we have delivered to you, you agreeing to pay on or before a certain date.

We can deposit this acceptance in our own bank, thereby giving us immediate use of the money already invested in the merchandise which you have in your possession, without extra cost to you.

According to a FEDERAL BANK GOVERNOR'S OPINION, the signing of an Acceptance increases the financial standing of the giver, because it shows prompt paying methods.

Kindly sign attached Acceptance, then forward to TAFEL ELECTRIC CO. INCORPORATED Louisville, Ky.

(OVER)

Trade Acceptance Form Adopted by Louisville Jobber and Retail Dealer.

business. There is thus created an asset which becomes available as credit at local banks and by the latter the trade acceptance may be rediscounted at the reserve banks. The strength of this kind of paper lies in the fact that it represents actual sales of merchandise passing from the producer to the consumer. It is regarded as a liquid asset, because it is based upon strictly current commercial transactions, and is all of short-time maturity. The trade acceptance is more liquid and more readily negotiable than the promissory note, which may merely represent money borrowed to clean up obligations, with no current transaction as a basis. The trade acceptance involves no long-time credits, but is a short-time credit to facilitate the resale of the goods purchased. The acceptor pays no interest, the drawer of the acceptance discounts it at his bank and thus avoids having his funds tied up in carrying his customers as formerly under the book-account system. He is relieved of the burden of acting as banker as well as jobber.

The H. C. Tafel Electric Company, in inaugurating among its customers the trade acceptance system, offered special advantages to those who would adopt its use. The company outlines terms of payments in four classes, the first two pertaining to cash payments, and the other two to settlement by trade acceptances. In regard to cash payments, the customer who pays the company's invoices ten days after their date, or who pays total invoices twice a month, is entitled to cash discounts of one per cent to five per cent on certain specified material and supplies; and those who pay the monthly account on the tenth of the following month are entitled to a discount of 2 per cent on all purchases except on wires, cords and Westinghouse apparatus, heating devices not included.

Those not in position to pay the monthly account by the tenth of the month following, are asked to give their 30-days' acceptance covering the amount of purchase, receiving a discount of 1 per cent on all goods covered thereunder except wires, cords, and all Westinghouse apparatus, heating devices not included. In case 60 days' time is desired, the customer is asked to give his trade acceptance for 60 days, but with no discounts. Customers are advised that there are no interest nor other charges on these acceptances, and that accounts amounting to less than $25 are not to be covered by such acceptances. It is evident that these acceptances are alike applicable to dealers who purchase from the jobbing department and to customers who buy from the retail department in sums of $25 and over.

NEW USES FOR THE ELECTRIC FAN.

A current of air from the electric fan, shown in Fig. 1, strikes several fabric tubes filled with water, cools the water for drinking purposes, lowers the temperature of the room, and acts as a sanitary measure as the current of air also strikes a deodorizer, filling the room with the disinfectant from the same. The temperature of the room is cooled by the air striking the fabric tubes filled with water, which evaporates, causing the temperature to be several degrees lower in the room than would be the case if only the fan were operated.

Fig. 2 shows a temporary expedient that was adopted to clear a basement of smoke. A fire in Los Angeles filled a department-store basement with smoke. The electrician collected 30 electric fans which were employed to force the smoke towards the sidewalk. A hole was broken through quickly and two fans installed as shown to act as a suction. The smoke was removed quickly without inconvenience to the patrons or clerks, who remained in ignorance of the fire.

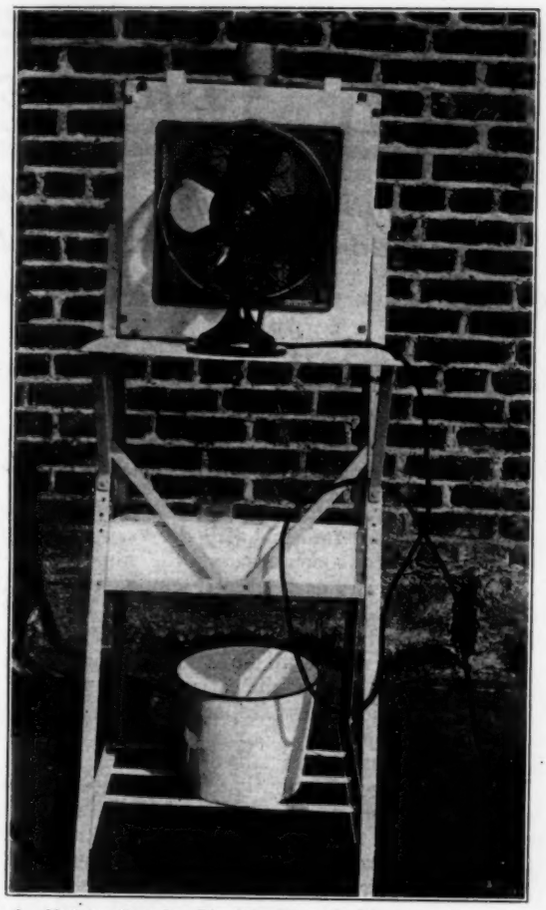


Fig. 1.—Unique Use for Electric Fan. Cooling Drinking Water, Lowering Room Temperature and Disinfecting in One Operation.

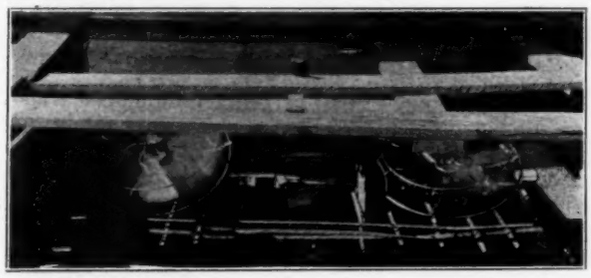


Fig. 2.—Fans Used to Remove Smoke From a Basement. 30 Fans Force the Smoke to the Opening in the Sidewalk.

A large and airy but unfinished attic room in a building occupied by a school was suddenly needed in order to accommodate an extra class. It took only a few days to wire and plaster it but the time required for natural drying could not be spared and use of the common salamanders was inadvisable because of fire hazard. Three 16-inch electric fans were placed on boxes and turned so as to keep a continual circulation of air throughout the room. With windows open and the fans running for a day and night, the fresh plaster dried quickly so that carpenters and decorators could finish the room shortly.

These are only a few of the miscellaneous uses that dealers should bring to the attention of fan purchasers to increase their sales.

Electric Vehicles

National Co-operative Delivery—Central Station Charges Laundry's Electrics—A Battery Rental Service In Practice

FREIGHT AND PACKAGE DELIVERY BY EXPRESS.

Principles of Co-operative Delivery on National Scale, Economic, Efficient, Rapid, Impartial.

By A. Jackson Marshall,

Secretary, Electric Vehicle Section, National Electric Light Association.

During the last several months the press has been flooded with articles treating with the very broad subject of freight transportation, as the importance of this vital subject has been greatly emphasized by the war. To a relative few, this major subject has always been deemed worthy of far more consideration than usually was accorded it in more normal times, when concerns, who bestowed microscopical scrutiny on other, and sometimes less important phases of their businesses, were inclined to assume that their deliveries were being systematically dispatched.

Too often, the distribution of commodities was delegated to those not especially skilled in all the intricacies of the many sided transportation problem, and equipment was ofttimes purchased, whether it be horse drawn or motor vehicles, that was supposed to meet requirements, rather than first making an exacting and comprehensive analysis of conditions, and then selecting equipment that such findings prompted. In other words, there was a tendency to buy truck equipment rather than transportation service. Transportation engineering in such cases was conspicuous by its absence.

A comparatively small percentage of mobile transportation equipment installed was approximately one hundred percent right. The rest was of varying degrees of good, bad and indifferent. Same may be said of operating methods in vogue. Accurate, all-embracing, operating costs were known and appreciated by only a comparatively small percentage of truck operators. Most operators seemed too busy making money to devote time and study to determining exactly what was going out for truck operation. It was more a matter of guess work, and such cases indicated a wide variation in costs for the same character of equipment applied in like work. The mere statement that there does not exist even today any adopted national standardized cost accounting system (although one or more are in process of development) as a basis of arriving at comparative costs, by which relative efficiencies may be determined and improvements effected, serves to indicate lack of progress that has been made in this fundamental phase of truck selection and operation. The deficiencies reflected publicly these last several months, long since pointed out by transportation engineers, cannot be construed in any way as an indictment against trucks in general, as each and every type of truck is well suited to successfully perform work in some given direction. A truck, which for a given work would be ideal, if improperly assigned to some other class of work could not be expected to give the same degree of satisfactory service. It is a case of fitting round pegs into round holes and square pegs in square holes. But ofttimes we find "square peg" trucks attempting to do "round hole" work. The inconsistency should appear obvious, but it would seem that it required this great war to cause a realization that somewhere some of the essential features in our transportation operations have been overlooked which it is enabling us to learn.

So much has been said and written about the shortcomings of prevailing truck transportation operating methods that extensive reiteration would seem superfluous here. Besides, it is more in order to be constructive. What we really desire are logical, simple remedies. Speedy action is essential. To be specific, let us cite some conditions in New York City, especially as these are more or less representative. Traffic congestion in the streets border on chaos. These conditions are getting worse—not better, and ere long will approach the saturation point. Then what? Shall we calmly await the speedy arrival of such unbearable conditions, or shall they be anticipated and suitable remedies effected?

On the streets of New York there are about four times as many trucks as are required. These numbers are daily being increased, because, for the most part, concerns and individuals each employ their own separate equipment to transport their merchandise, and because these trucks are not anywhere near loaded to capacity, going and coming. In practice, about four trucks with their drivers and helpers are employed to do the work, which one, well selected, managed and operated truck, with its one crew of men (or women), could do, if practical and scientifically correct methods obtained.

All manner of suggestions to relieve this situation have been forthcoming. They range from pleas for wider streets to bigger freight terminals. Widening the streets is not only enormously expensive, but furthermore, not altogether always practical and possible. Bigger terminals sounds good, but where is the land to build them coming from—likewise the money—to say nothing of labor and materials, which are not easily to be had these days. Further, must wider, and still wider streets, and bigger terminals, always be the goal, until perhaps the city consists solely of streets and terminals, at least, until the terminals likewise must vacate so that the space thus gained be given up for more streets?

At present the city streets are used principally during the day. During the night, when pedestrian and passenger vehicle traffic is at its minimum, the streets are comparatively deserted. Why not employ the streets during the night for the movement of freight by means of quiet, rapid-moving vehicles? On account of not having to buck congested traffic, with attending delays and accidents, much faster average speed could be safely made, besides, trucks operating over all, or a larger part of a twenty-four-hour day keeps investments active, and the cost per mile is

correspondingly reduced. Such change will necessitate revision in our customary mode of existence. But such development requires but little, if any sacrifice or inconvenience, and virtually no expenditure of money, labor and material, otherwise more urgently needed. Suppose, for example, the railroads only used their tracks during the day and they remained idle during the night. The same question might be asked about city streets, especially those other than of a strictly residential character.

But to get down to the root of the matter, what is the principal solution for prevailing trucking inefficiency? Co-operative trucking? Yes, but better still, centralized trucking,—co-operative trucking on a national co-ordinated scale. How? By companies, possessed of the qualifications as found in national express concerns. Companies whose business is transportation, where employment of transportation is not merely an incidental or a side issue. Companies whose business success is based on the economic and efficient transportation of material and commodities and who first, know what and how to buy the best suited transportation equipment, secondly, who can and do operate such equipment to secure maximum results with minimum delay and expense. This is their business. They know it because they have scientifically studied it, and have successfully worked out their theories in actual practice. They are specialists.

It may be of interest to state that several years ago the writer advanced the idea of freight handling by express companies. In normal times, "something new" had a hard road to hoe. It is no longer a question of "maybe," but a case of necessity, for transportation must be brought to the highest possible point of efficiency in the shortest space of time to help our Government "win the war." Delays are dangerous.

Store-door delivery, by means of centralized and highly organized agencies, if developed to the point where extensive service will be rendered communities, will automatically eliminate surplus trucking equipment; make men, capital and equipment available for vital war-winning work; relieve acute traffic congestion on city streets, with an appreciable improvement in the matter of safety; effect enormous economies in transportation costs which now represent a large percentage of the total cost of commodities to the ultimate consumer; reduce amount of time now ordinarily required for deliveries; expedite more rapid and freer movement of freight, to, from and through existing freight terminals; relieve freight-car shortage situation, and otherwise effect improvements necessary in these critical times.

Furthermore, it may be reasonable to assume that transportation equipment selected for such extensive and scientific transportation will be of a character best suited to fully measure up to requirements, tending to bring about a standardization situation which will prove generally beneficial. After such a system has been in operation for a not very lengthy period, and theories have had sufficient opportunities to be practically worked out in practice, the new order of practice will appear so logical that we will be inclined to wonder why it had not been introduced before. In general effect, the principle underlying store-door delivery methods of freight is not greatly dissimilar to the methods which have been in vogue for many years in the handling of express matter, the principal difference being that freight is somewhat more bulky than express and consequently may move slightly less speedily. Therefore, store-door delivery cannot be characterized as a revolutionary movement insofar as principle is concerned, for the same general idea has been successfully employed for a number of years by express organizations, and it is the knowledge which they have thus gained, coupled with their close association with the railroads, which will enable them to carry such development to a successful conclusion.

ISOLATED PLANT OPERATES ELECTRICS ON CENTRAL STATION SERVICE.

In the past it has been considered as rather difficult for the central-station company to connect up such loads as hospitals, laundries and similar undertakings requiring large amounts of steam and hot water, because under such circumstances heat is needed in any case and electrical energy is considered as a by-product. However, as in the case of many large downtown buildings, it is frequently found cheaper eventually to purchase central-station service for light and power.

The Silver State Laundry, Denver, Colo., operates a private plant which supplies steam and hot water to the laundry, for heating the premises and also electric light and power for the buildings and operation of the various machines and appliances employed in laundering. Nevertheless, this laundry purchases central-station service from the local central-station company, for its fleet of electric delivery trucks, of which there are at present ten.

The Silver State Laundry Company is one of the oldest laundries in Denver, having been in active operation since 1894. It is also amongst the most progressive, as is shown by the fact that it operates 10 delivery wagons for the collection and delivery of laundry, and furthermore, purchases energy from the local utility for charging them.

The energy for charging them is obtained from a 25-horsepower motor-generator set installed on the premises for changing the alternating current supply to direct current. The energy consumption by these ten Ward trucks varies between 2000 and 2500 kilowatt-hours monthly. This is equivalent to about 250 kilowatt-hours per truck per month.

Ten Ward Trucks in Use by Silver State Laundry Company, Denver, Colo. They Are Charged by Central-Station Service Although the Laundry Operates a Private Plant.

A BATTERY RENTAL SERVICE.

Method in Vogue in Chicago by Which Truck User Rents Battery Service for Monthly Charge.

Notwithstanding the economical operation of the electric truck and its low cost of maintenance resulting from its inherent characteristics of few working parts, rugged design, slow running parts, smooth acceleration and ease of control, absence of severe strains, economy on tires and roads, and low cost of energy as compared with gasoline, the use of a storage battery of relatively high cost has from the first constituted one, if not the chief, drawback to the wider adoption of the electric vehicle. However, as time goes on and more and more electric trucks take to the road the popular disadvantages of the battery disappear.

The facts that the storage battery is an expensive piece of apparatus, is capable of destroying itself, and if not properly maintained, deteriorating rapidly with time have acted as a deterrents to the use of the electric truck by many. There is also another fact that sometimes prevents a prospective truck user from purchasing an electric, and instead he finally purchases a gasoline truck, notwithstanding its higher operating costs and shorter life, namely, the attention required. With many smaller concerns having various sorts of transportation to perform the initial cost is an important factor. Even with electric truck costs on the decrease, and it follows the more trucks are made the lower the price, their high initial cost often is the barrier to the concern with small purchasing power.

If now a truck can be purchased without a battery —which costs roughly from $300 to $1000, for a lead battery, according to size—the electric is at once placed in much more favorable circumstances as compared with the gasoline, on basis of initial cost or money required or capital tied up, and the purchaser is in fact on a par with the purchaser of a gasoline truck, so far as investment is concerned. If it is possible to rent a battery and charge this rental to operating expenses and transportation charges still be below those were a gasoline vehicle employed a very real gain accrues to the truck user unable to find capital to invest in a battery.

A Workable Battery Rental.

A battery rental service has been in vogue in Chicago for a considerable length of time that has not only proved the success of the venture, but has already proved the value of such a service to the prospective electric truck user who either cannot afford to purchase a battery or else does not desire to be bothered with one.

For a great many applications transportation costs for the electric truck are lower than for the gasoline, because of the lower costs for maintenance, energy, insurance, lubricant, fewer delays and higher quality of service. By renting a battery it is possible to place battery costs, except that for energy, on a definite basis, constant throughout the month, and thus a truck owner is relieved of worry and concern. Chicago already possesses a garage service, in operation by the Commonwealth Edison Company, by which, for a rental based upon floor space plus charges for battery charging and washing of the truck, a truck owner is able to have his trucks garaged and maintained in working order at a fixed schedule of rates. All he purchases therefore is the truck, both garage and battery service being purchasable upon a monthly basis.

A battery rental service is maintained by the K. W. Battery Company, 1532-1534 Michigan avenue, Chicago, that deserves mention, for it has proved a boon to many truck owners and has also benefited the local electric truck industry in that battery costs and troubles no longer stand in the way of adopting an electric truck.

This company rents out storage batteries of the lead type, of their own make, at definite rates per month according to the size of battery. Under the contract signed between the battery company and the truck owner it is agreed that the former shall furnish a battery of definite capacity, shall maintain it in proper working condition and not allow its capacity to go below 80 per cent of rated capacity, shall not permit delays chargeable to the battery to exist for longer periods than 24 hours. In exchange the truck owner agrees to pay a fixed rental for the battery service, payable monthly in advance, with the understanding that one month's notice must be given on desiring to terminate the contract. The truck owner is responsible for keeping the battery charged and in fit condition, the lessor agreeing to maintain the battery in fit condition for working.

The K. W. Battery Company, on the above basis, has several hundred batteries out on rental for use by electric trucks in Chicago and vicinity. It might be thought at first that a battery rental service would be taken advantage of by the small truck owners only, operating only one or two trucks. This is not borne out by experience, however, for some quite large truck operators have taken up the battery service. Some of these are given in the accompanying table. Altogether there are several hundred batteries out on rental.

Name of company.	Number of trucks.
Consumers Company	30
Anderson & Goodman Ice Cream Company	11
Lincoln Ice Company	4
Gottfried Brewing Company	6
Pilsen Brewing Company	5
Weiland Ice Cream Company	2
Oak Park Baking Company	2
Piper Baking Company	4

As to the satisfaction of this method of furnishing battery service, and thus shifting possible troubles and anxieties of battery maintenance to others better able to care for them, it might be mentioned that the Consumers Company has recently renewed its contract for rented battery service for their thirty trucks for another two years. The trucks in question are used for ice and coal delivery.

Several years' experience with rented battery service proves its success. Truck users like the system because they find it makes for satisfactory vehicle performance, fewer delays, lower initial outlay of capital, fewer complaints and lower all-round expense.

A workable battery rental service—and this is proved by actual experience—saves operating costs and extends the life of a battery, it reduces the cost per mile of haulage, less capital is required for commencing electric truck transportation and launching out upon scientific electric trucking, time and troubles are saved, and there is insurance and assurance against delays and breakdowns. When employing battery and garage service, transportation costs are a known quantity and the only variable is that of energy costs, which depends upon the mileage and load of the truck. A workable battery rental service removes the chief obstacles that have stood in the way of the small truck user—the high cost of a battery and his ignorance of how it works and how best to keep it working.

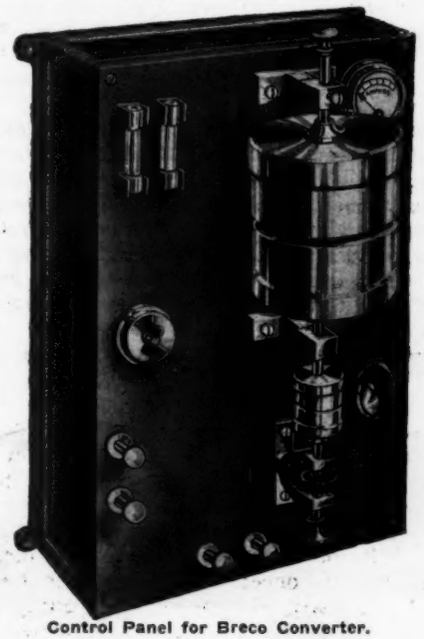
New Appliances

Breco Converter for Use in Garages, Movie Theaters, Etc. —Electric Kitchen Mounted on Truck for Use by the Army

THE BRECO CONVERTER.

The numerous uses for which direct current is required have made the problem of rectifying or converting of alternating into direct current an important one. Where such conversion is to be done under the care of an attendant not technically trained in electrical matters it is evident that simple and reliable converting equipment is necessary; if this equipment can be made relatively inexpensive another desirable feature is attained.

These aims were kept in mind in the investigations that led to the invention of what is known as the Breco converter illustrated herewith. This outfit includes a new principle in the way of a commutating device. It is simple in construction, easily and efficiently operated, and low in cost. The Breco converter as arranged for storage-battery charging includes a transformer that steps down the alternating-current supply voltage; from the transformer the current is brought to the commutator where it is rectified. Electrically connected in series with the commuator is a graphite-arc valve and a special electric timer; the timer is so arranged that just at the time when sparking might occur the current is shunted to the graphite-arc valve and this permits of perfect commutation. The commutator is operated by a small synchronous motor. The entire outfit is neatly and compactly arranged as shown. It requires practically no attention except starting and stopping by means of a switch on an automatic control panel shown in the second illustration; this takes care of the proper starting and regulation of the device and relieves the operator of all but the connection of his battery or batteries and cutting off of the charging. The outfit is automatic in its action. If line current fails, the converter stops charging and cuts out the battery; when power is re-established it starts charging again and this without the use of any delicate auxiliary apparatus whatever.



Control Panel for Breco Converter.

The Breco Converter.

From this brief description it is evident that this converter possesses marked advantages. These may be summarized as follows: Ease of operation and control, ruggedness of construction and unlikelihood of trouble developing, economy in first cost, efficiency in service. These machines have been tried out in actual operation for long periods in every-day service. The results of these trials are entirely satisfactory and guarantee success to follow general installation. In fact, this trial period has extended from 1911 to the present time. In tests of the device conducted in the electrical laboratories of Cornell University, a careful examination of the oscillograph records obtained proved absolutely that no reversed current passes through the converter. It has been shown by the same tests that in practical operation of this converter the smaller machines have an efficiency of from 75 to 80 per cent and the larger machines an efficiency of 90 per cent. This high efficiency is due to the fact that the current is merely commutated and not regenerated; it is necessary to use only a fractional-horsepower motor that consumes very little energy, since all it has to do is to revolve the commutator.

The Breco converter is made in sizes to meet the requirements of charging starting and lighting storage

batteries, electric car and truck batteries, supplying direct current to motion-picture arcs, signal and alarm systems, telephone and telegraph applications, portable electric drills, magnetic separators and clutches, garage and service stations and power purposes. The machines range in price from $24 up and are built in capacities of from one battery up. They can be made for any capacity, phase, or frequency, or to meet special requirements. Breco converters are manufactured by The Breco Electric Company, 206 Huron street, Toledo, Ohio. The company also makes a desulphator or a device to break down sulphation in lead storage batteries. This machine is made on the same basic principles; it has been shown that a battery connected directly across 110 volts for 60 hours without results has been broken down with the Breco desulphator in 30 minutes, so that it would take a charge and that without the temperature rising 20 degrees.

AN AUTOMOBILE ELECTRIC KITCHEN.

A new automobile electric kitchen has been designed and built by the Duparquet, Huot & Moneuse Company, primarily for army use. It consists of a standard Ford touring car and Smith Form-A-Truck attachment on which are mounted a small direct-current generator and a number of insulated cooking compartments. The cooking compartments are fitted with electric heating units and provided with passages for

An Automobile Electric Kitchen for Army Use.

the exhaust gases from the engine, the heat of which materially assists in the cooking operations.

The vehicle body is 10 feet long and 4 feet wide, and is fitted with a canvas top of the regulation army type, with sides extending to protect the operator from the weather. Eighteen-inch hinged side platforms are fitted which, when in position, provide access to all cooking departments, and when closed lie within the clearance line of the vehicle.

The generator is of standard General Electric construction, totally inclosed, and is rated 6.5 kilowatts, 125 volts, 1800 revolutions per minute, and is designed for continuous operation at rated load. The generator is driven from the transmission shaft of the automobile by silent chain. Voltage is judged by pilot lamp and regulated by the speed of the engine, no instruments being necessary. Protection against short-circuit and overload is provided by an overload circuit-breaker and fuses. A larger, and for many purposes more desirable, equipment employing a 12-kilowatt generator, could be mounted on a two-ton truck.

Water for cooling the engine is contained in a heavy galvanized-steel tank located in an insulated compartment at the rear of the vehicle. The water is circulated through the engine and radiator by means of a centrifugal pump mounted on the engine. This cooling water may be used for culinary purposes, if the pipes, radiator, etc., are occasionally flushed out and cleaned.

The baking compartment is 18 inches wide and high and 24 inches deep. It is provided with six removable racks and will hold six shallow baking pans or two large roasting pans. It is heated by four 9-inch-by-12-inch 1600-watt cast-iron electric hot plates. The sides, top, and doors are heavily insulated. The doors are supported by pin hinges and can be quickly removed when the oven bottom is to be used for frying or making griddle cakes.

All methods of cooking, with the exception of broiling, have been provided for. Broiling can be done by installing an electric broiler in the top of the oven.

Underneath the oven, and heated by it, is a warming closet large enough to hold roasting pans. This closet is fitted with drop doors on both sides for serving purposes. Under the warming closet are located the switches, circuit breaker, and all fuses for heating circuits.

There are four fireless-cooker compartments, each having a capacity of 30 gallons. The insulation, which is two inches thick, is fireproof, self-supporting, light in weight. Monel metal was selected for the fittings, interiors, and insulated covers because of its strength and non-corrodible qualities. These compartments have semi-hemispherical bottoms to facilitate cleaning and draining, and are provided with draw-off faucets. All seams are welded or silver soldered, and if heat is accidently turned on, with no water in the vessel, no damage will result. A closet with drop door is located under each vessel for storing utensils. These compartments are heated by the engine exhaust, and by two General Electric sheath wire units wound on steel supports. No porcelain parts, lava, or other fragile substance is used for insulating these units.

A single large equipment, or two smaller equipments, will esaily prepare the regulation rations, consisting of four courses, with coffee, for a company of 250 men, or coffee and one pint each of stew for 500 men. In army camps or elsewhere where regular ranges are available this equipment can be advantageously used as an auxiliary. It would not be necessary to supplement the range by cooking in galvanized ash cans over wood fires or similar methods, as is now practiced in some of the camps. Where electric current is available all of the equipment, with the exception of the hot-water tanks, can be operated without running the engine or generator.

Because of the efficient insulation of all cooking compartments it is necessary to operate the generator at its full capacity for only a short ime. In ordinary cooking operations the fuel consumption will, of course, also depend upon the extent to which the operator takes advantage of the fireless cookers. Cooking can be done as long as the engine runs. In case of complete breakdown, current can be supplied from the generator of a second car, if this is available, and the exhaust heat from this car used to continue the cooking operations, thus keeping both kitchens in service. The second car could also tow the disabled one, if necessary.

The electric generator could also be used to supply light or power for any purpose within its capacity. For instance, the 6.5-kilowatt generator could supply current for 246 25-watt lamps or 650 10-watt lamps, or power for the electrical equipment of a field hospital for X-ray work, sterilizing, etc.

While performing this service the exhaust heat could be employed for cooking and heating the water.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

RUTLAND, VT.—Rutland Railway, Light & Power Company has contracted to supply five additional horsepower to the plant of the Wallingford Manufacturing Company.

SPRINGFIELD, VT.—Colonial Power & Light Company is planning for the immediate construction of an 11,000-volt transmission line to the plant of the Woolen Mill Company, Proctorsville. The company has recently contracted to supply about 100 kilowatts of secondary power for the operation of the plant.

BOSTON, MASS. — The United States Government has had plans prepared for improvements and alterations in its power plant at the local navy yards. C. W. Parks, Washington, D. C., is chief of the Bureau of Yards and Docks.

WALPOLE, MASS.—New England Telephone & Telegraph Company, 50 Oliver street, Boston, is having plans prepared for the construction of a one-story telephone building, about 50x50 feet in size, on Main street.

NORWICH, CONN.—Eastern Connecticut Power Company has awarded a contract for the construction of a large one-story local steam power station. Fred T. Ley & Company, 409 Main street, Springfield, Mass., are the contractors.

BROOKLYN, N. Y.—State Hospital Commission has had plans prepared for the construction of a power plant at the Brooklyn State Hospital.

BUFFALO, N. Y.—A total of $150,000 has been subscribed to the Third Liberty Loan by the Buffalo General Electric Company.

BUFFALO, N. Y.—Delaware, Lackawanna & Western Railroad Company has awarded a contract for the construction of a one-story power house on Currie street, East Buffalo. The J. W. Cowper Company, Inc., Fidelity building, Buffalo, is the contractor.

BUFFALO, N. Y.—Kellogg Products Company, 98 Delaware avenue, has awarded a contract for the construction of a one-story brick pumping plant, about 30x40 feet in size, to be located at 1317 Elk street. B. I. Crooker, Builders' Exchange, is the contractor.

BUFFALO, N. Y.—Niagara, Lockport & Ontario Power Company has subscribed a total of $100,000 to the Third Liberty Loan.

NEW YORK, N. Y.—Clark Electric & Manufacturing Company has recently acquired a factory building at 22026 Vanderbilt avenue, near Flushing avenue, Brooklyn, about 75x100 feet in size, to be used as an addition to its plant.

NEW YORK, N. Y.—B. E. Davis Company, Inc., 250 Hudson street, has awarded a contract for the construction of an eight-story storage battery building on Hudson street, between Broome and Dominick streets. The Pershing Construction Company, 309 Broadway, is the contractor.

NEW YORK, N. Y.—E. J. Electric Installation Company, 221 West Thirty-third street, has filed notice of an increase in its capital from $10,000 to $50,000, to provide for expansion.

NEW YORK, N. Y.—Interborough Rapid Transit Company is making rapid progress in the construction of its power house at 154 West Sixteenth street, one-story, about 62x103 feet, to cost $40,000.

NEW YORK, N. Y.—Novo Manufacturing Company, 424 West Thirty-third street, has filed notice of an increase in its capital from $100,000 to $150,000 to provide for expansion. The company engages in the manufacture of electrical goods.

NEW YORK, N. Y.—Metropolitan Electric Lamp Company has leased space at 18 East Seventeenth street, to provide for increased capacity.

NEW YORK, N. Y.—United Electric Light & Power Company has purchased a site at 115 W. 97th street for the erection of a power house.

NIAGARA FALLS, N. Y. — Star Electrode Works of the National Carbon Company have awarded a contract to Braas Brothers, 110 Whitney avenue, Niagara Falls, for the construction of a new mixing and milling building, one-story, at their plant.

NIAGARA FALLS, N. Y.—Niagara Falls Gas & Electric Light Company has had preliminary plans prepared for the construction of a new local gas manufacturing plant. Willis Adams, Loan Association Building, Niagara Falls, is engineer.

NIAGARA FALLS, N. Y.—National Carbon Company, Cleveland, O., has filed plans for the construction of two local factory buildings, four-story, about 50x60 feet, and one-story about 48x88 feet, respectively, to be located on Buffalo avenue. The structures are estimated to cost $27,000.

OLEAN, N. Y.—Olean Electric Light & Power Company will purchase additional equipment. Address general manager.

PORTCHESTER, N. Y.—Liberty Electric Corporation, manufacturer of electric goods, has awarded a contract for the construction of a one-story addition, about 60x100 feet in size, to its plant. The structure is estimated to cost $8000. George Mertz & Sons, East Portchester, are the contractors.

SYRACUSE, N. Y.—Syracuse Lighting Company has subscribed a total of $20,000 to the Third Liberty Loan.

SYRACUSE, N. Y.—Syracuse Lighting Company is planning for the immediate extension of its lines to the town of Geddes for the purpose of supplying electric service for industrial, domestic use, etc. Permission has been granted by the Public Service Commission.

SYRACUSE, N. Y.—Best Electric Wire Company, manufacturer of electric wire, etc., has filed notice with the Public Service Commission of the dissolution of the company.

BLOOMFIELD, N. J.—Sprague Electric Company has filed plans and awarded a contract for the construction of a one-story brick and steel addition, about 100x180 feet, to its plant along the Erie Railroad. The structure is estimated to cost $35,000. The Austin Company, Transportation building, Philadelphia, Pa., is the contractor.

DOVER, N. J.—New Jersey Power & Light Company has contracted with the Thomas Iron Company for supplying additional power for the operation of a new compressor recently installed at one of its mines.

HARRISON, N. J.—Driver-Harris Company, manufacturer of electrical wires, etc., has subscribed $10,000 to the Third Liberty Loan.

KEARNY, N. J.—Swift & Company, Jersey City, have awarded a contract to the Ruggles-Robinson Company, 331 Madison avenue, New York, for the construction of a one-story power house to provide for the operation of a glue factory now in course of erection, the entire work to cost $65,000. The company has also had plans prepared for the erection of a two-story addition to its engine house at 154 Ninth street, about 45x55 feet.

OGDENSBURG, N. J.—New Jersey Zinc Company, 55 Wall street, New York, is considering plans for the immediate reconstruction of its local one-story power house to replace the structure recently destroyed by fire. The new plant is estimated to cost about $15,000, and will be of brick construction.

ORANGE, N. J.—Radium Luminous Materials Corporation, Alden street, has taken out a building permit for the construction of a four-story plant, to be located at 166 Alden street.

PERTH AMBOY, N. J.—Employes of the New York & New Jersey Telephone Company have subscribed $5000 to the Third Liberty Loan.

TRENTON, N. J.—John E. Thropp Sons Company, Lewis street, is having preliminary plans prepared for the construction of a one-story brick and concrete power plant at its works. J. O. Hunt, 114 North Montgomery street, Trenton, is architect.

HARRISBURG, PA.—The branch telephone exchange of the Philadelphia & Reading Railway Company has entered the 100 per cent Liberty Bond class, every employe having subscribed.

PHILADELPHIA, PA. — Electric Storage Battery Company has had plans

prepared for the construction of an addition to its building at Nineteenth street and Allegheny avenue. The existing structure will also be improved.

PHILADELPHIA, PA.—Employes of the local branch of the General Electric Company have subscribed $58,400 to the Third Liberty Loan.

PHILADELPHIA, PA. — Alfred Moore Electrical Company, 200 North Third street, has subscribed $25,000 to the Third Liberty Loan.

PHILADELPHIA, PA.—Royal Ascot Knitting Company, 92 Collom street, has taken out a building permit for the construction of a one-story stone boiler plant addition at 240 East Ashmead street.

PHILADELPHIA, PA.—St. Joseph's Hospital, Seventeenth street and Girard avenue, has awarded a contract for alterations and improvements in its boiler plant. James Johnston, 1721 Ludlow street, Philadelphia, is the contractor.

WILMINGTON, DEL. — William Freihofer Baking Company has awarded a contract for the construction of a new one-story brick, steel and concrete boiler plant addition at its works, about 43x46 feet in size. The Philip Halbach Construction Company, Philadelphia, Pa., is the contractor.

WASHINGTON, D. C.—Chesapeake & Potomac Telephone Company, Thirteenth and G streets, N. W., has awarded a contract for the construction of its proposed telephone exchange plant, to cost about $820,000. The Samuel J. Prescott Company, 814 Thirteenth street, N. W., Washington, is the contractor.

WASHINGTON, D. C.—Washington Railway & Electric Company has recently placed an order with the G. C. Kuhlmann Car Company, Collinswood, Ohio, for additional rolling stock of the pay-within type. The cars are to cost about $12,000 each.

NITRO, W. VA.—Virginian Power Company, Charleston, is considering plans for the immediate extension of its transmission system to Nitro, a distance of about 16 miles, for the purpose of supplying power to the new explosive plant of the Government.

REIDSVILLE, GA.—The city is having plans prepared for the construction of an electric lighting system. A bond issue of $10,000 has been authorized for this purpose.

SARASOTA, FLA.—The city officials are considering plans for the construction of an electric light and power plant.

NORTH CENTRAL STATES.

CINCINNATI, OHIO.—Union Gas & Electric Company will install a third electric unit. Address M. E. Trimble, 405 Race street, manager.

TOLEDO, OHIO.—The council will place 50 additional arc lights in the streets. Address Electrician John Mulholland, chairman of city lighting.

EVANSVILLE, IND.—The Indiana Public Service Commission has denied authority to the Evansville Railroad Company to take up two and one-half blocks of street railway track in Rockport, Ind., on the ground that the company is under obligation to serve the vital needs of the town.

INDIANA HARBOR, IND. — The Powers-Thompson Company, Joliet, Ill., has secured the contract for the new steel plant for the Mark Manufacturing Company at Indiana Harbor. The original appropriation was for two million dollars but it is estimated that the completed building will cost five million dollars.

CHICAGO, ILL. — City Electrician Keith reports that 17,000 additional street lights will be installed by the end of this year.

PEORIA, ILL.—Chicago, Ottawa and Peoria Railway Company, a subsidiary of the Illinois Traction System, has applied to the Illinois Public Utilities Commission for permission to abolish the zone fare system and to charge two cents a mile straight. The company also asks to charge three cents a mile from passengers boarding cars without tickets and to eliminate the sale of round-trip tickets.

SPRINGFIELD, ILL.—Following its announced policy of restricting building operations not vital to the success of the war, the Illinois Public Utilities Commission has denied a certificate of convenience and necessity to the Chicago, Fox Lake & Northern Railway, which organization proposed to build an interurban line from Palatine, Ill., north into Wisconsin. The new company also proposed to buy the property of the Waukegan, Rockford & Elgin Traction Company, but this will not be allowed by the Commission.

SPRINGFIELD, ILL. — Mississippi River Power Company has petitioned the Illinois Public Utilities Commission to renew notes aggregating $2,419,500.

BELLAIRE, MICH.—The sum of $6000 in bonds have been voted to improve the electric light plant. Address village clerk.

OREGON, WIS.—Bids are being asked for furnishing electric pumping machinery. Address C. A. Hanan, village clerk.

RUSHFORD, MINN.—Root River Power & Light Company will extend its lines from Caledonia to Houston, where the company will install a complete electric system during the coming summer months.

STILLWATER, MINN.—All buildings for housing the new plant of the Twin City Forge & Foundry Company have been completed and the work of installing machinery is now under way. One unit will be in operation by May 15 and another by June 1. This company will be operated electrically with power furnished by the Northern States Power Company.

EDDYVILLE, IOWA.—The sum of $8000 in bonds has been voted for municipal lighting. Address village clerk.

MADRID, IOWA. — Peoples' Telephone Company is planning to make a number of improvements to its plant during the summer. Harry C. Grimmer, manager.

MONTICELLO, IOWA.—The directors of the Monticello Electric Light Company voted to build a number of lines into the country. Farmers on the proposed lines will take electric light power.

RED OAK, IOWA.—Application for authority to extend its transmission line in Pleasant township has been made by the Red Oak Electric Company. Address the manager.

KANSAS CITY, MO.—Kansas City Light & Power Company is 277 street lights behind in its contract with the city council. The company has, however, installed 500 electric lights which have replaced 600 gas lights.

KANSAS CITY, MO.—Kansas City Electric Light Company is erecting a power plant in East Bottoms at an estimated cost of $3,000,000.

ST. LOUIS, MO.—Bell Telephone Company has increased the wages of its operators in that city 11½ per cent, amounting to an increase of $85,000 annually in the pay roll. About 1400 persons have been affected by the raise. The company declined to state what the wage scale was before the increase was made.

CARROLL, NEBR.—The sum of $9500 in bonds has been voted for municipal lighting. Address village clerk.

HEARTWELL, NEBR.—Bonds to the amount of $2700 have been voted

DATES AHEAD.

Pacific Coast Section of National Electric Light Association and California Association Electrical Contractors and Dealers. Joint convention, May 9, 10 and 11, Del Monte, Cal.

American Association of Engineers. Annual meeting, May 14, 1918. Secretary-Treasurer, A. H. Krom, 29 South La Salle street, Chicago.

Arkansas Association of Public Utility Operators. Annual convention, Arlington Hotel, Hot Springs, Ark., May 21-22-23. Secretary-Treasurer, R. B. Fowles, Pine Bluff, Ark.

Electrical Supply Jobbers' Association. Annual meeting, Homestead Hotel, Hot Springs, Va., May 21-22-23. Secretary, Franklin Overbagh, 411 South Clinton street, Chicago.

Electrical Contractors' Association of Georgia. Annual meeting, Tybee Island, Ga., June, 1918. Secretary, Dan Carey, 614 Chamber of Commerce building, Atlanta, Ga.

American Society of Mechanical Engineers. Spring meeting, Worcester, Mass., June 4-7. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

National Electric Light Association. Annual convention, Hotel Traymore, Atlantic City, N. J., June 13 and 14. Secretary, T. C. Martin, 33 W. 39th street, New York City.

Texas State Association of Electrical Contractors. Annual meeting, Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Southeastern Section, National Electric Light Association. Annual meeting, June 19-20, 1918, Atlanta, Ga. Secretary-Treasurer, T. W. Peters, Columbus, Ga.

American Institute of Chemical Engineers. Summer meeting, Berlin, N. H., June 19-22. Headquarters, Mt. Madison House, Gorham, N. H. Secretary, John C. Olsen, Brooklyn, N. Y.

American Institute of Electrical Engineers. Annual convention, Atlantic City, N. J., June 26-28. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 10-12. Secretary, D. L. Gaskill, Greenville, Ohio.

National Association of Electrical Contractors and Dealers. Annual convention, Cleveland, Ohio, July 17-20. Secretary, Harry C. Brown, 101 West 40th street, New York City.

Northwest Electric Light and Power Association; affiliated with N. E. L. A. Annual meeting, September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

for electric lighting. Address village clerk.

LYNCH, NEB.—A bond issue of $7800 has been voted for the municipal light plant. Address village clerk.

BRADLEY, S. DAK.—Dakota Northern Power Company will erect a power building and purchase electrical machinery. E. L. Lewis, secretary.

FARGO, N. DAK.—The Fuel Administration of North Dakota has lifted restrictions on public and private lighting.

SOUTH CENTRAL STATES.

LEXINGTON, KY.—Fayette Home Telephone Company is having plans prepared for the construction of a two-story brick telephone exchange plant, about 35x45 feet in size, to be located at Versailles. Frank L. Smith, Lexington, is architect.

LOUISVILLE, KY.—Childers Electric Company, manufacturer of electric supplies, has filed notice with the Public Service Commission of an increase in its capital from $4,000 to $20,000, to provide for expansion.

LOUISVILLE, KY.—Commercial department of the Louisville Gas & Electric Company during the week ended April 27 accepted three power contracts covering 249 horsepower in motors. The Kentucky and Indiana Terminal has added 169 horsepower in motors for the operation of its machine shops.

GUEYDAN, LA.—The city has authorized a bond issue for $15,000 to provide for the construction of an electric lighting system.

BLACKWELL, OKLA.—The Oklahoma attorney-general has approved of a bond issue of $82,500 for electric lighting facilities, $15,000 for a fire station and $77,500 for waterworks betterment.

DALLAS, TEX.—The city commission is planning ways and means to increase the city lighting. Address Commissioner Lang.

DALLAS, TEX. — Dallas Railway Company has submitted to the city commission an estimate which has been approved for an expenditure of $121,940 in relaying the double tracks on Second avenue and other improvements to its electric railway lines here.

DALLAS, TEX.—It is stated by E. P. Turner, president of the Dallas Northwestern Traction Company and the Dallas Southwestern Traction Company that the construction of the interurban electric line between Dallas and Irving by the Dallas Northwestern Traction Company will be finished within the next few months. Delay is being met with in obtaining some parts of the right of way. The construction of the interurban electric line that is to run from Dallas to Glen Rose, a distance of about 60 miles, by the Dallas Southwestern Traction Company will not be started until after the war.

KNIPPA, TEX.—Preliminary surveys have just been made for a large irrigation system and hydroelectric plant that are to be constructed on the Frio River near here. The site of the proposed impounding dam across the Frio River is situated about fourteen miles north of Knippa. Charles A. Lindsey of Wichita, Kans., and associates who are promoting the project have made the necessary application to the State Board of Water Engineers for authority to divert and utilize the water of the stream for the purposes outlined. The proposed dam will afford storage for about 5000 acre feet of water which will be conveyed through a system of canals and ditches to irrigate approximately one hundred thousand acres of valley land. How much electrical energy may be developed by the water supply is not stated, but it is planned to transmit the power to San Antonio and a number of smaller towns by means of a system of voltage lines.

McKINNEY, TEX.—McKinney Telephone Company has filed notice of an increase in its capital from $45,000 to $125,000, to provide for extensions, improvements, etc.

WESTERN STATES.

ALBANY, ORE.—The Albany division of the Oregon Power Company recently secured orders for 10 electric signs containing a total of 927 lamps within a one week period.

HANFORD, WASH. — Blackrock Power & Irrigation Company has filed application at the land office asking for an easement for construction of a transmission line of about 35 miles from Priest Rapids to this place. The line is to carry 66,000 volts, term asked is 50 years and the rental $5 per mile. It is assumed that the company contemplates irrigating a large portion of land lying above the proposed high line canal.

TACOMA, WASH. — Commissioner Charles D. Atkins and City Attorney U. E. Harmon appointed by the city council to devise ways and means of raising money for purchasing more cars for the municipal street car system to the tide flats. It is probable that they will recommend that bonds be issued on the new system in the sum of $300,000 to refund the present bonds and provide money for purchasing more cars.

ASTORIA, ORE.—Extensive preparations are being made by the Hammond Lumber Company for additional electric power equipment that will quadruple the capacity of the Pacific Power & Light Company. The Hammond Lumber Company has signed a contract for another turbine and generator of 2000 horsepower capacity, capable of furnishing 3000 horsepower for several hours at a time. In addition to this four six hundred horsepower water tube boilers have been purchased.

STOCKTON, CAL. — The Stockton division of the Western States Gas & Electric Company is serving the Sperry Flour Mills with an additional 315 horsepower in motors, making a total power installation for this concern of 453 horsepower. The new power installation will operate at a high load factor and is particularly desirable business from the central station standpoint. The flour company is milling large quantities of flour for export to France.

PROPOSALS

ELECTRICAL EQUIPMENT.—Bids will be received by the lighthouse inspector, Boston, Mass., for generating sets and switchboards.

SOUNDING NAVIGATIONAL MACHINES.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for 120-volt, direct-current, motor-driven sounding navigational machines on schedule 1793.

PUMPING STATION.—Bids will be received on June 6 by the clerk of the Sanitary District of Chicago for the construction of a sewerage pumping station. The specifications include six 1000-kilovolt ampere transformers, three 1100-horsepower synchronous motors, two 450-horsepower synchronous motors, three 300-horsepower synchronous motors, six 50-kilovolt ampere transformers, two 75-kilowatt motor generator sets, and oil switch equipment. Control switchboard and accessories, conduit and wiring for connecting all electrical equipment, and for station lighting and power, installation of electrical equipment. Address John McGillen, clerk, Room 700, 910 South Michigan avenue.

INCORPORATIONS

TERRELL, TEX.—Brantley Electric Company has incorporated with a capital of $2000. Address A. L. Brantley.

HOBOKEN, N. J.—Dilwood Manufacturing Company. Capital, $50,000. To engage in the manufacture of wireless apparatus, etc. Incorporators: Nathaniel P. Hill, Montclair; Ernest E. Davis, Hoboken, and George C. Sprague, Englewood Heights.

MARTINSBURG, W. VA.—Berkeley Battery Company. To manufacture electric batteries and other electric equipment. Incorporators: Everett H. Truman, W. H. S. Nelson, and W. C. Kilmer.

ELKHART, IND.—Reid Electric & Supply Company has been incorporated with capital of $10,000. The incorporators are Brice H. Reid, L. P. Reid and A. F. Warren.

NIXON, TEX.—Nixon Electric Light & Power Company has incorporated with a capital stock of $12,000. Incorporators: J. F. Wood, Jr., W. L. Hoover and C. T. Moreno.

TISHOMINGO, OKLA. — G. W. Piersol Company, Oklahoma City, has purchased $20,000 light and water bonds.

MILWAUKEE, WIS.—Jonas-Lalley Light Company has been incorporated with a capital of $25,000. Address August A. Jonas, 728 Wells street.

LOS ANGELES, CAL.—Bannister Hydro Electric Company. Capital, $200,000. To engage in the manufacture of hydroelectric gauges, and other electrical devices. Incorporators: George R. Bannister, Robert B. Bannister, Perry H. Brown, I. L. Brunk, and D. Sattler, all of Los Angeles.

PEORIA, ILL.—Stopp Electric Company has been incorporated with capital of $10,000 by C. E. Stopp, C. F. Theobold and E. T. Cunningham.

CLEVELAND, OHIO.—Elite Electrical Company has filed papers of incorporation to engage in the sale of electrical supplies. The incorporators are J. Bartels, R. Stoltenberg and M. Walsch.

Trade Activities

Ohio Electric & Controller Company Incorporates—Western Electric Opens Memphis Branch—Catalogs Distributed

General Devices & Fittings Company, designer, engineer, and manufacturer of electrical products, has removed its executive and sales offices and engineering department from its factory located at 817-25 West Washington boulevard, Chicago, to the Mid City Bank building. The entire sixth floor of this building will be occupied by the company and will provide greatly increased office facilities and drafting room space.

Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., has just issued a four-page, two-color envelope folder (Publication 232) which shows several applications of C-H push button porcelain sockets. White porcelain sockets are especially adapted for use in the bath room where the socket and fixture should be in keeping with the white porcelain and enamelware. The folder points out the distinctive features of C-H porcelain sockets, such as the ease of installation, 660-watt capacity, and shock-proof shell. The pendant type is best suited for factories, storehouses and basements, and due to the push-button mechanism requires only one hand to operate.

Ohio Electric & Controller Company, 5900 Maurice avenue, Cleveland, Ohio, announces its recent incorporation with a capital stock of $200,000. The new concern will engage in the manufacture of lifting magnets and electrical controlling devices. Lifting magnets will be built at once and controlling devices will be manufactured later. The officers of the company include F. W. Jessop, president; W. B. Greene, vice-president; and A. D. Walter, secretary and treasurer. Mr. Jessop was formerly works manager of the Electric Controller & Manufacturing Company, Cleveland. He has had an extensive experience in the manufacture of lifting magnets and electrical apparatus for the control of motors.

Matthews Electric Supply Company, located at 2014 First avenue, Birmingham, Ala., announces its retirement from the retail electrical equipment business in order that its entire personnel may devote its entire time exclusively to the growing wholesale trade. This company has under the able and energetic management of C. R. Matthews and H. W. Matthews, grown from a comparatively small concern to such proportions that the annual sales now exceed the value of $1,000,000, and the firm has become one of the largest wholesale distributors of electrical equipment in the South, handling not only the General Electric Company's line of equipment, but many other standard lines as well. The trade territory of the Matthews company extends over the states of Alabama, Georgia, Florida and Tennessee and is continually spreading out over a larger area.

Anderson Electric Specialty Company, manufacturer and patentee of specialties, formerly located at 564 West Van Buren street, Chicago, has now established its general office and factory at 118-124 South Clinton street. One of the products of this company is the "Adapt-a-Lite" which is a very unique portable lamp that may be attached to any existing lamp socket. A special feature of the "Adapt-a-Lite" is the reel "unit," consisting of a handsomely finished ball casing, which contains a winding mechanism and a drum carrying 10 feet of insulated lamp cord. It is comprised of a reel, socket, patent adjustable shade and a bracket of novel design. It is an "all-purpose" lamp and has been found to be of intrinsic value to the user.

Ward Leonard Electric Company, Mount Vernon, N. Y., recently issued Bulletin 50, entitled "Method of Determining the Size of a Battery Charging Rheostat." The method described is quick and simple and may be applied to any specified line voltage, number of cells of battery, charging rate and type of battery, and the many advantages afforded by Ward Leonard plates in this connection are clearly set forth. The bulletin is well illustrated, showing the various types of Ward Leonard rheostats and resistances and their particular applications.

Wilson Welder & Metals Company, Inc., 52 Vanderbilt avenue, New York City, has just published a Manual on Electric Welding, which discusses every phase of electric welding work. It contains complete instructions covering the installation, care, operation and maintenance of Wilson electric welding equipment, also directions to be followed in welding various kinds of metal, grade of welding wire to be used, amount of current or heat values to employ, with useful information for the engineer, foreman or welder. Photographic reproductions with tabulated data are shown, and these will serve as a guide under any conditions that may arise in the electric welding field. The Wilson system is the result of many years of scientific research and experimental work by electrical engineers, and has been endorsed as one of the most advanced state of art, both as to economy in operation and high character of product. The manual takes up the scope of work of this line of equipment, and points out those superior qualities which have contributed to its success. It is said to be the only device which enables any number of welders to work from one large machine without one welder interfering with the work of another. One of the important features of the Wilson system is the uniformity of the welding, which is due to the fact that the heat is controlled at the point of application. The vital importance of using metals that are not adversely affected by the heat of the electric arc has been realized by the Wilson company with the result that a special welding metal in the form of an electrode has been prepared. This is composed of a homogenous alloy combined with such excess of manganese as will compensate for losses while passing through the electric arc, thus assuring a substantial amount of manganese in the welded joint, which is essential to its toughness. The manual contains numerous wiring diagrams, wiring table, a detailed description of motor-generator sets together with other valuable information. Photographic reproductions of typical examples of prepared and finished work are shown, two of the most notable instances being the repair of a badly broken cylinder on the U. S. S. George Washington and the welding of a most difficult break of the first intermediate cylinder of the U. S. S. Pocahontas, formerly the German ship Princess Irene.

Western Electric Company, with main offices in New York City, announces the opening of a branch office at Memphis, Tenn., with headquarters in the Lotus building. The Memphis branch will serve western Tennessee, eastern Arkansas, northern Mississippi and western Kentucky. Thirty persons will be employed, including several traveling salesmen who will reside in Memphis. A general line of electrical and telephone supplies, motors, generators and pole line material will be carried in stock. The office will be in charge of E. P. McGrath, of St. Louis, and his assistant, W. T. Wheeler.

Cooper Hewitt Electric Company, with general offices and works at Hoboken, N. J., and branch offices in the principal cities of the United States, is distributing an attractive calendar covering the remaining months of this year, beginning with May, and the first four months of 1919. Each page of the calendar shows an attractive illustration of an installation of Cooper Hewitt lamps, showing the wide range of uses to which this lighting unit has been put. Perhaps one of the most interesting of these installations is that in the Treasury Department, Bureau of Engraving and Printing, Washington, D. C. The power press department, which is working day and night, turning out Liberty bonds, war saving certificates and thrift stamps, is completely illuminated with Cooper Hewitt lamps that are particularly valuable in this application because of the uniformity of the light distribution, elimination of glare from the highly polished plates and the high acuity of vision they produce.

Men in Service

Prof. D. C. Jackson Appointed Major—Public Service Corporation Service Flag—Prof. L. J. Corbett Commissioned

C. B. OWENS has resigned his position as manager of the Boonville Light, Heat & Power Company, Boonville, Mo., to enlist in the Thirty-seventh Engineers.

E. F. WALZ, JR., for the past five years in charge of the Philadelphia warehouse of the Robbins & Myers Company, has resigned his position and is now chief petty officer of the navy, stationed at the Philadelphia navy yard.

FRED M. REAST, who resigned his position with the engineer inspection branch of the Western Electric Company to enlist in government service, was recently commissioned a second lieutenant in the Quartermasters Corps and is now stationed at Camp Holabird, Baltimore, Md.

PUBLIC SERVICE CORPORATION, Newark, N. J., recently raised a new service flag on the roof of the Public Service Terminal, having the figures 1062 arranged with stars. This flag represents employes from all of the Public Service divisions throughout the state now with the colors. The first flag, which was raised last fall, had the figures 688.

ROBBINS & MYERS COMPANY, with main offices and factory at Springfield, Ohio, has added the following names to its roll of honor: J. M. Schmidlin, Arthur Thompson, Felix Lee, William Sturgeon, Martin Habis, Orville Higgins, John F. Cook, Ray Beekman, William Lythe, Chris Klinke, Charles R. Walker, Fred Shiveley and James N. Robinson.

DETROIT EDISON COMPANY, Detroit, Mich., in the September and December issues of Synchroscope published the names of 266 employes who had joined the army and navy up to November 15, 1917. Since that date, and up to April 1, the honor roll of Detroit Edison men in the service of the government has been extended by the addition of 101 new names, making a total of 367 Edison employes in war service.

PACIFIC GAS & ELECTRIC COMPANY, San Francisco, Cal., now carries on its roll of honor the names of 419 employes who have enlisted in the service of the country. The enlistments from the various departments and districts of the company are as follows: San Francisco, general offices, 44; Alameda county, 70; Chico, 1; Colgate, 6; Contra Costa, 9; De Sabla, 8; Drum, 5; Electra, 10; Fresno, 9; Marin, 7; Marysville, 21; Napa, 4; Nevada, 3; Petaluma, 1; Placer, 5; Redwood, 21; Sacramento, 28; Sacramento supply, 5; San Francisco, auditing and accounting department, 3; bookkeeping department, 11; collection department, 4; commercial department, 9; electric distribution department, 30; electric generating department, 24; gas distribution department, 15; gas manufacturing department, 7; records, 2; San Francisco supply, 10; San Joaquin, 4; San Jose, 30; Santa Rosa, 2; Salano, 3; Vallejo, 1; and Yolo, 3.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

PROF. DUGALD C. JACKSON, the head of the department of electrical engineering of the Massachusetts Institute of Technology, has received the commission of major in the Engineer Reserve Corps and has been ordered to France. Major Jackson began his educational work as professor of electrical engineering at the University of Wisconsin from 1891 till 1907, at which time he was called to the Massachusetts

Maj. Dugald C. Jackson.

Institute of Technology to fill the chair of electrical engineering. In the same year he was placed in charge of the department at the institute, a position which he still retains. In 1913 he became a member of the staff of the electrical engineering research laboratory. This laboratory led to the establishment at the institute in 1917 of a division of electrical research, of which he was one of the directors. Major Jackson has been president of the American Institute of Electrical Engineers and of the Society for the Promotion of Engineering Education. He is a member of other national associations, including the American Society of Civil Engineers, the American Society of Mechanical Engineers, also of the English Institution of Electrical Engineers and La Société Internationale des Electriciens. He has contributed largely to the literature of electrical engineering.

W. H. Dow, acting purchasing agent for H. M. Byllesby & Company, Chicago, has joined the 37th Engineers at Columbus Barracks, and will shortly go to Fort Meyer, Virginia.

H. M. BYLLESBY & COMPANY, Chicago, has issued a folder, giving the names and assignments, as of January 1, 1918, of the executives and employes of the organization in military and naval service, and shows a total of 376 names.

LIEUT. HAROLD FLAGER, formerly with the engineering staff of the Puget Sound Traction, Light & Power Company, Seattle, Wash., has been transferred from the officers' training camp, Camp Lee, to Camp Wheeler, Ga.

CHIEF PETTY OFFICER WILLIAM G. HAZEL, U. S. N., formerly connected with the Philadelphia and New York offices of the Robbins & Myers Company, has successfully passed the examinations for the position of assistant paymaster, with the rank of ensign.

MARTIN B. BUCKLEY, formerly a power salesman in the new business departments of Henry L. Doherty & Company, New York City, is now a captain in the coast artillery, stationed at Fort Morgan, near Mobile, Ala. Captain Buckley expects to be ordered to France shortly.

CHARLES GRUNSKY, formerly on the engineering staff of the California Railroad Commission, but who during the past year was commissioned a first lieutenant of the 5th U. S. Engineer Train, was recently promoted to the rank of captain in the 5th U. S. Regulars (Engineer Corps).

W. R. THOMPSON, formerly in the engineering and construction department of H. M. Byllesby & Company, has entered military service and is now a captain, at Battle Creek, Mich. A. H. Sayce, also of the Byllesby engineering department, has joined the Officers' Reserve camp at Fort Sheridan.

PROF. L. J. CORBETT, head of the electrical engineering department of the University of Idaho, has received a commission as captain in the Engineer Reserve Corps and is now stationed at Camp Lee, Va. Professor Corbett has during the past seven years been at the head of the electrical engineering department of the university. Prior to that time he was engaged in consulting engineering work in Spokane, along hydraulic, irrigation and electrical lines. He is also a member of the board of examiners of architects of the state of Idaho.

Personal

F. E. McCall Resigns—Thomas M. Cluley Joins W. A. McCombs Company—R. F. Pack Appointed Labor Arbitrator

J. F. CANFIELD has been appointed auditor of the Ottumwa Company, Ottumwa, Iowa, succeeding C. Brazel.

CYRUS SCHUMACHER, for the past 10 years superintendent of the Bluffton Light & Water Works, Bluffton, Ohio, has resigned his position to engage in the manufacture of air motors.

FRED C. PULLEN has resigned as Belleville manager of the St. Clair County Gas & Electric Company. He has been with this company for several years, having formerly been a sales manager.

J. F. OWENS, vice president and general manager of the Oklahoma Gas & Electric Company, Oklahoma, Okla., was elected president of the Oklahoma Gas, Electric & Street Railway Association at the annual convention held in Oklahoma City recently.

H. A. COWGILL, formerly with the traction department of the St. Joseph Railway, Light, Heat & Power Company, is now general superintendent of the Mansfield, Ohio, traction system. The Mansfield system has now the equivalent of 22 miles of track including the interurban to Shelby.

THOMAS M. CLULEY, who for the last 22 years has been associated with the Union Electric Company, has resigned to join the forces of the W. A. McCombs Company, Pittsburgh, Pa. This company manufactures Maco safety switches and is also territorial representative of a number of well known manufacturers.

J. B. TAFT, division publicity manager for the Bell Telephone Company, Harrisburg, Pa., has been appointed copy manager for the Bell Telephone Company of Pennsylvania and associated companies, including the Central Diamond State Telephone Company, Diamond State Telephone Company, and the Delaware & Atlantic Telephone Company, with headquarters at Philadelphia, Pa. Mr. Taft assumed his new duties on May 1. He is succeeded by H. E. Prevost, of Harrisburg.

A. B. CRONKHITE, formerly district commercial superintendent of the Western Union Telegraph Company, St. Louis, Mo., has been named general manager of the newly created lake division of the same company with headquarters at Chicago. The lake division comprises an area of about 250,000 square miles, embraces the state of Illinois, Indiana, Ohio, Michigan and Wisconsin, and is the second largest division of the Western Union system. Mr. Cronkhite was born in Marion, Ind., in 1878 and entered the service of the Western Union Telegraph Company as a messenger at the age of 15. Subsequent promotions took him through many positions with the company among which have been the position of field representative at the Indianapolis office and district superintendent of the Indianapolis territory.

R. J. SWAIN, for the last 12 years electrician for the city of St. Boniface, Man., has been elected an associate member of the Canadian Society of Civil Engineers.

JOHN D. RYAN, president of the Montana Power Company, Butte, Mont., and the Anaconda Copper Company, was recently appointed director of aircraft production for the army.

F. E. MCKENNA, formerly superintendent of the Oregon Power Company at Coquille, has been transferred to Marshfield as general superintendent for the Coos Bay division of the Oregon Power Company.

C. BRAZEL, auditor of the Ottumwa Railway & Light Company, Ottumwa, Iowa, has been appointed auditor of construction department of the Northern States Power Company, with headquarters at Minneapolis.

R. A. COVELL, who for some time has been connected with the New Haven office of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has become office manager of the New York branch of the company.

GEORGE WILLIAMS has been elected a director of Cities Service Company, New York City, succeeding John C. Mitchell of Denver, whose duties with the Federal Reserve bank have prevented his attendance at many directorate meetings.

J. E. BOISSEAU, publicity manager of the Chesapeake & Potomac Telephone Company for five years and later publicity manager of the Bell Company of Pennsylvania, was recently elected vice-president of the National Union Bank of Maryland at Baltimore.

BRUCE S. NICHOLS, who has been with the Cutler-Hammer Manufacturing Company for about one year in Milwaukee and New York, has been transferred to the Philadelphia office where he will act as sales engineer in the mining regions of Pennsylvania.

H. W. KING has resigned his position as superintendent of distribution for the East St. Louis Light & Power Company to become associated with the Sangamo Electric Company of Springfield, Ill. A banquet was tendered in his behalf at the Planters' Hotel in St. Louis by the St. Louis Electric Club.

F. E. MCCALL, who has been connected with the sales division of the Philadelphia Storage Battery Company for two years, recently joined the sales forces of the Walker Vehicle Company, Chicago. Prior to his connection with the Philadelphia company, Mr. McCall spent three years in the employ of the Commonwealth Edison Company, whom he served as an electric vehicle engineer in the contract department. He was at one time secretary of the local section of the Electric Vehicle Association of America, which has been merged with the Vehicle Section of the National Electric Light Association.

F. W. LACHICOTTE, JR., manager of the Chester (S. C.) Southern Public Utilities Company, has become superintendent of the electrical department of the branch located at Charlotte, N. C.

FRED D. WILLIAMS, head of the power specialties department of the H. W. Johns-Manville Company, Philadelphia, Pa., has resigned to become assistant general manager of the L. H. Gilmer Company, Tacony.

FRANK L. FOX, who for the past four years has been manager of the Thomasville (S. C.) branch of the Southern Public Utilities Company, has been transferred to the Chester (N. C.) branch of which he will be manager.

PROF. F. H. NEWELL, head of the department of civil engineering at the University of Illinois and organizer and director of the United States Reclamation Service, was recently awarded the Cullom Geographical Medal by the Geographical Society of New York. Professor Newell is a prominent member of the American Society of Mechanical Engineers and the American Association of Engineers.

ROBERT F. PACK, vice-president and general manager of the Northern States Power Company, Minneapolis, Minn., has been appointed a member of the State Board of Arbitration and Conciliation by Governor Burnquist. This board was organized following the ratification of an agreement between official representatives of labor and capital interests in Minnesota, and it has been agreed by them that all labor troubles in this state will be settled within its borders without appealing for federal assistance. The voluntary agreement to submit all disputes to this board has been incorporated into an official order of the Minnesota Council of Safety. Several controversies have already been settled without loss of work, time or production.

Obituary.

STANLEY E. VAN FLIET of Auburn, Ind., aged fifty-two, general manager of the Bell Telephone Company, died recently.

FRANK SHUMAN, inventor of the sun motor for the development of power from the heat of the sun, died, on April 28, at his home, 3400 Disston street, Tacony, Pa., aged 56 years.

B. P. WAGGENER, who placed in operation the Atchison Railway, Light & Power Company, which was later sold to the Illinois Traction System, died April 28 at his home in Atchison. He was attorney for the Missouri Pacific Railroad for 42 years. He had served several terms in the upper and lower houses of the Kansas Legislature and had also been mayor of Atchison. He was at the time of his death president of the Atchison Exchange National Bank, which position he had occupied for a number of years.

Financial News

Maintenance of Public Utilities.

At the sixth annual meeting of the Chamber of Commerce of the United States, held in Chicago, on April 10, 11 and 12, 1918, the following resolution was passed:

"Whereas, The maintenance of the country's public utilities in the highest possible state of efficiency is essential not only to the war program of the United States but also to the nation's business, industrial and public interests, and,

"Whereas, Such efficiency depends upon the preservation of the credit of the companies providing public utility service; and,

"Whereas, The increase of costs and the unusually onerous conditions of operation brought about by the war seriously threaten the ability of the public utilities to continue the furnishing of the necessary services they perform; and,

"Whereas, The proportion of the credit of public utilities is very largely in the hands of regulatory commissions and other public authorities rather than in the utilities themselves;

"Now, Therefore, be it resolved, That the Chamber of Commerce of the United States recommends to state and local authorities that they recognize the unusual and onerous conditions with which public utilities are contending, and that in the interest of the nation, of business, and of the public, they give prompt and sympathetic hearing to the petitions of such utilities for assistance and relief."

Copper Prices.

June 1 is the date on which the Government price of copper will go into effect for the third four-months' period. During the preceding eight months the price has been maintained at 23½ cents per pound, with a jobbers' price of 24.67½ cents, the latter being the price at which private consumers buy. The result of a conference, held May 1, between the copper producers and refiners and the War Industries Board, has not been announced. The pressure for an advance in price comes principally from refiners, who claim costs of labor and material in refineries have increased to a greater extent than they have at mines and smelters. Gradually the jobbers are beginning to do a heavy business, showing lately increased buying by domestic consumers. More than 10,000,000 pounds was reported sold last week. The Government and jobbers' prices certainly will not become less after June 1, and an advance is among the possibilities.

Rockland Light & Power to Issue Stock.

The Rockland Light & Power Company has been authorized by the Public Service Commission to issue $300.000 par value of its common stock to be sold at not less than par. The proceeds will be used for the discharge of the first mortgage bonds of the former Nyack Gas Light & Fuel Company, for the purchase of improvement notes of the Rockland Electric Company of Closter, N. J., for the discharge of outstanding notes, for certain additions and improvements and for the reimbursement of the treasury for the moneys expended for capital purposes since November 30, 1915.

Northern New York Utilities Bonds Authorized.

The Public Service Commission of New York has authorized the Northern New York Utilities Company to issue $480.000 par value of its 5 per cent fifty-year first and refunding mortgage bonds to be sold for not less than 80, and $144,000 of 7 per cent cumulative first preferred stock and $79,200 common capital stock to be sold at not less than par. The proceeds from the sale of these securities will be used for construction and additional facilities. This order was later superseded by a second order fixing the price for the bonds at 85 and authorizing the issue of $128,000 in preferred stock and $64,000 in common stock.

United Gas & Electric Net Income Shows Gain.

Operating results of subsidiary companies of the United Gas & Electric Corporation show a decrease in net income for the year ended December 31 last of $139,963 and in gross income of $329,233. Gross earnings for the period increased $1,127,119. The income account, with comparisons, follows:

	1917.	1916.
Gross earnings	$16,287,275	$15,160,156
Net income	7,288,946	7,428.909
Gross income	6,132,576	6,461,809
Fixed charges	3,575,989	3,503,166
Balance available for dividends, etc.	2,556,587	2,058,643

The balance sheet as of December 31 last shows cash in banks and on hand, $249,578. Profit and loss surplus, $803,075, and liabilities and assets, $46,482,272.

Western States Gas & Electric Company Earnings.

Net earnings of the Western States Gas & Electric Company for the month of March show an increase of 5.7 per cent over those for March, 1917, and the net for the year ended March 31 shows an increase of 5.4 per cent over the corresponding previous period. Comparative statement is reported as follows:

Month of March—	1918.	1917.
Gross earnings	$ 125,789	$ 107,541
Net earnings	51,946	49,133
Year ended March 31—		
Gross earnings	1,456,568	1,270,176
Net earnings	639,249	606,507

Increased Rates Granted Illinois Utilities.

The Illinois Public Utilities Commission has granted the request for higher rates filed by the Springfield Gas & Electric Company for electric current furnished the Springfield Consolidated Railway Company. Both are controlled by the Union Railway, Gas & Electric Company, the increase being a matter of bookkeeping only. The commission also granted the Southern Illinois Light & Power Company permission to increase rates for a period of one year following April 1, after which time it must again appeal to the commission for further instructions in rates.

Consolidated Gas Company Increases Rates.

The Consolidated Gas Company, controlled by the American Light & Traction Company, of New York City, and operating in Asbury Park, Red Bank, Long Branch, N. J., and vicinity, has been granted permission by the Board of Public Utility Commissioners to add a war surcharge of 10 cents per 1,000 cubic feet to its rates for gas, and a similar surcharge of four-tenths of a cent a kilowatt hour to the schedule for electric current, the new rates to be effective May 1.

Colorado Power Earnings Show Increase.

For the year ended December 31, 1917, the Colorado Power Company reports consolidated net income of $357,655 after expenses and charges, an increase of $80,690 over 1916. Gross operating revenue was $1,183,750 and net revenue $676.301, compared with $1,020,310 gross and $562,781 net for 1916. Dividends paid on the preferred stock amounted to $44,718, while dividends on the common stock totaled $221,264. In 1916, dividends on the preferred and on the common stock were $35,000 and $276,580, respectively. Profit and loss surplus, as of December 31, 1917, was $619,959, an increase of $91,161.

Groton Electric Power Stock.

The Groton Electric Power Corporation was recently authorized by the Public Service Commission to issue $20,000 of its common capital stock to be sold at not less than par. The proceeds of this sale will be used in financing the construction of a transmission line and provide additional working capital.

Increase in U. S. Bond Deposits.

According to advices received from Washington, the Comptroller of the Currency reports that during the three months ended March 31 last there were deposited as security for national bank notes United States bonds to the amount of $18,767,350. During the same period there were withdrawn United States bonds to the amount of $14,288,100. The increase during the period in bonds held amounted to $4,479,250. The United States bonds on deposit on March 31 for the purpose indicated aggregated $688,060,510.

Merchants' Heat & Light to Issue Bonds.

The Merchants' Heat & Light Company, Indianapolis, Ind., has asked the Indiana Public Service Commission to authorize an issue of $140,000 in 5 per cent gold bonds, to be sold at not less than 85, and also an issue of $60,000 in capital stock to be sold at not less than 90, the proceeds to be used together with $178,000 in cash to buy the Danville (Ind.) Light, Heat & Power Company. The Danville company has been buying electric current of the Indianapolis company and serving Danville, Clarmont, Brownsburg, Avon and adjacent rural districts.

United Light Net Earnings Show Gain.

The United Light & Railways Company reports a gain in net earnings as well as in gross for the year 1917, an unusual performance for a utility holding corporation. The parent corporation saved $599,013 out of gross receipts of $2,054,893, as compared to net of $597,480 saved for the stock in the previous year. The income account of the subsidiaries shows net of $1,163,673, as compared to $1,275,880 in the previous year.

The income account of the holding company compares as follows:

	1916.	1917.
Earnings available on stocks owned by United Light & Railways Company	$1,257,490.42	$1,150,369.04
Dividends and interest receivable	477,642.44	608,611.61
Miscellaneous earnings	183,688.44	295,913.28
Gross earnings	$1,918,821.30	$2,054,893.93
Expenses and taxes	146,908.14	147,273.03
	$1,771,913.16	$1,907,620.90
Interest on bonds and notes	578,640.34	703,049.89
	$1,193,272.82	$1,204,571.01
Dividend on first preferred	595,792.50	605,557.50
Balance available for common stock dividends, depreciation, etc.	$ 597,480.32	$ 599,013.51

Including interest to United Light & Railways Company.

Second preferred stock has all been converted.

Dividends.

The board of directors of the Mobile Electric Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock of the company, payable May 15 to stockholders of record April 30.

Montreal Light, Heat & Power Company has declared its regular quarterly dividend of 2 per cent, payable May 15 to stock of record April 30.

J. G. White & Company, Inc., has declared the regular quarterly dividend of 1½ per cent on the preferred; J. G. White Engineering Corporation has declared regular quarterly dividend of 1¾ per cent on the preferred, and the J. G. White Management Corporation regular quarterly dividend of 1¾ per cent on the preferred stock, all payable June 1 to stock of record May 15.

Earnings.

PACIFIC GAS & ELECTRIC COMPANY.

Preliminary Income Account—12 Months Ended February 28, 1918.

	1918.	1917.
Gross operating revenue:		
Electric department	$11,054,622.75	$10,099,221.82
Gas department	7,830,577.05	7,451,530.57
Other departments	1,196,225.83	1,101,375.54
Total gross operating revenue	$20,081,425.63	$18,652,127.93
Expenses:		
Maintenance	$ 1,215,887.99	$ 1,148,458.92
Operating and general	9,177,727.57	7,411,566.02
Taxes	1,271,421.22	1,015,036.89
Reserves for casualties and uncollectible accounts	240,000.00	230,000.00
Reserve for depreciation	1,250,000.00	1,250,000.00
Total expenses	$13,155,036.78	$11,055,061.83
Net earnings from operation	$ 6,926,388.85	$ 7,597,066.10
Add profits on merchandise sales and other miscellaneous income	543,678.88	444,858.46
Total net income	$ 7,740,067.73	$ 8,041,924.56
Bond or other interest	4,135,942.18	3,844,241.03
Balance	$ 3,334,125.55	$ 4,197,683.53
Apportionment of bond discount and expense	185,087.37	175,138.79
Surplus	$ 3,149,038.18	$ 4,022,544.74
Dividends (accrued) on preferred stocks.	1,486,388.50	1,415,174.69
Balance	$ 1,662,649.68	$ 2,607,370.05

TWIN CITY RAPID TRANSIT COMPANY.

	1918.	1917.
March gross	$ 835,293	$ 916,605
Net earnings	220,902	306,166
Surplus after charges	60,206	156,072
3 months' gross	2,457,390	2,641,912
Net earnings	576,300	842,453
Surplus after charges	110,170	407,384

NIAGARA FALLS POWER COMPANY.

Niagara Falls Power Company and its subsidiary, Canadian Power Company, for the three months ending March 31, 1918, report earnings as follows:

Gross earnings	$ 766,305	$ 771,143
Net after taxes	554,363	563,524
Surplus after charges	305,428	314,589

AMERICAN POWER & LIGHT COMPANY.

The subsidiary operating companies now controlled by the American Power & Light Company, intercompany charges eliminated, report for March: Gross earnings, $1,042,084, increased $128,971; net earnings, $89,756, increased $21,790. For twelve months: Gross earnings, $11,785,237, increased $1,199,924; net earnings, $4,868,260, increased $173,166.

ILLINOIS TRACTION SYSTEM.

The annual report of the Illinois Traction System, Peoria, Ill., shows gross earnings of $14,461,408 in 1917, as compared to $12,556,477 in 1916. The company paid 7 per cent on preferred stock and 3 per cent on common stock. The company gained $791,209 in surplus, the surplus for 1916 being $677,518.

AMERICAN POWER & LIGHT COMPANY.

Earnings of subsidiary operating companies, excluding the parent company's figures for the month of February and for the 12 months ended February 28, 1918, are as follows:

	1918.
February gross	$ 1,109,709
Net after taxes	462,635
12 months' gross	11,656,266
Net after taxes	4,846,470

INSPIRATION COPPER COMPANY.

Inspiration Consolidated Copper Company has issued its pamphlet report for the year ended December 31, 1917, showing net income of $10,903,588 after all charges, including $1,185,249 provision for federal taxes, compared with $20,629,489 net income for 1916. Net income for 1917 was equal to $9.37 a share on 1,181,967 shares of stock ($20 par value), as against $17.45 a share earned in 1916. Comparative statement of earnings follow:

	1917.	1916.
Sale of copper	$21,242,217	$33,496,343
Operating expenses and federal taxes.	*9,588,629	11,965,820
Interest paid	.....	151,034
Depreciation	750,000	750,000
Net income	10,903,588	20,629,489
Other income	177,144	.....
Total income	$11,080,732	$20,629,489
Dividends	9,751,227	8,548,051
Surplus	1,329,505	12,081,438
Previous surplus	12,681,500	600,062
P. and L. surplus	14,011,055	12,681,500

*Provision for federal taxes amounted to $1,185,249.

LEWISTON, AUGUSTA & WATERVILLE STREET RAILWAY.

Earnings of the Lewiston, Augusta & Waterville Street Railway (Lewiston, Maine) for January and 12 months, follow:

	1918.	1917.
January gross	$ 41,120	$ 61,703
Net deficit	25,884	7,515
Interest, etc.	15,911	15,308
Surplus deficit	41,795	7,793
12 months' gross	883,790	812,480
Net	181,290	245,346
Interest, etc.	187,292	187,118
Preferred stock dividend	36,000	36,000
Balance deficit	42,002	22,228

THE WISCONSIN EDISON COMPANY.

	1918.	1917.
January gross	$1,172,051	$1,012,291
Net after taxes	263,247	371,934
Surplus after charges	77,622	229,445
12 months' gross	12,274,166	10,442,663
Net after taxes	3,832,490	4,168,106
Surplus after charges	1,938,823	2,562,834

GREAT WESTERN POWER SYSTEM.

	1918.	1917.
February gross	$ 348,451	$ 328,982
Net after taxes	211,524	211,536
Surplus after charges	71,213	75,472
12 months' gross	4,051,611	3,781,792
Net after taxes	2,508,319	2,410,131
Surplus after charges	837,748	1,013,839

EASTERN TEXAS ELECTRIC COMPANY.

	1918.	1917.
February gross	$ 80,409	$ 73,007
Net after taxes	35,888	33,827
Surplus after charges	26,183	24,044
12 months' gross	950,583	848,403
Net after taxes	420,661	394,105
Surplus after charges	303,138	284,668

NORTHERN STATES POWER COMPANY.

Gross and net earnings for the month of March and for the year ended March 31 compare with figures for the corresponding previous periods as follows:

Month of March—	1918.	1917.
Gross earnings	$ 651,803	$ 576,764
Net earnings	257,244	278,244
Year ended March 31—		
Gross earnings	7,420,871	6,353,050
Net earnings	3,269,453	3,396,051

CHICAGO, NORTH SHORE & MILWAUKEE RAILROAD.

Chicago, North Shore & Milwaukee Railroad has issued a report for year ended December 31, 1917, having changed its fiscal period from a year ending January 31, as required by the Interstate Commerce Commission. Due to this change the report covers the 17 months' period July 26, 1916, to December 31, 1917. The income account shows a surplus of $345,469 after all expenses and charges. Total operating revenue was $2,291,582 and net operating revenue was $822,958. Balance after taxes was $704,311. Gross income amounted to $710,236, which included $5,925 miscellaneous income.

Balance sheet as of December 31, 1917, shows current assets amounting to $681,479 and current liabilities of $630,576, current assets showing an excess of $51,173. Cash on hand totaled $377,675. Profit and loss surplus was $345,469.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Apr. 30.	Bid May 1.
Adirondack Electric Power of Glens Falls, common	6	13	13
Adirondack Electric Power of Glens Falls, preferred	6	70	70
American Gas & Electric of New York, common	10+extra	88	87
American Gas & Electric of New York, preferred	6	40	40
American Light & Traction of New York, common	..	196	190
American Light & Traction of New York, preferred	6	94½	94½
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	70	..
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	6	..	..
American Telephone & Telegraph of New York	..	97½	96¼
American Water Works & Elec. of New York, common	..	5	5
American Water Works & Elec. of New York, particip	7	13	13
American Water Works & Elec. of New York, first preferred	..	57½	58
Appalachian Power of Bluefield, common	..	2¼	2¼
Appalachian Power of Bluefield, preferred	7	20	20
Cities Service of New York, common	+extra	200	205
Cities Service of New York, preferred	6	74¼	74¼
Commonwealth Edison of Chicago	8	104	102¾
Comm. Power, Railway & Light of Jackson, common	..	21	20
Comm. Power, Railway & Light of Jackson, preferred	6	44	44
Federal Light & Traction of New York, common	..	6½	6½
Federal Light & Traction of New York, preferred	..	29½	29½
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	24
Middle West Utilities of Chicago, preferred	6	57	57
Northern States Power of Chicago, common	ex.div.7	40	43
Northern States Power of Chicago, preferred	ex.div.7	84	85
Pacific Gas & Electric of San Francisco, common	..	32	32
Pacific Gas & Electric of San Francisco, preferred	6	81½	80
Public Service of Northern Illinois, Chicago, common	7	74	73¼
Public Service of Northern Illinois, Chicago, preferred	6	82	86
Republic Railway & Light of Youngstown, common	4	22¼	22¼
Republic Railway & Light of Youngstown, preferred	6	56½	56½
Standard Gas & Electric of Chicago, common	..	4½	4
Standard Gas & Electric of Chicago, preferred	6	24	24
Tennessee Railway, Light & Power of Chattanooga, common	..	2¼	2¼
Tennessee Railway, Light & Power of Chattanooga, preferred	6	9¾	9¾
United Light & Railways of Grand Rapids, common	4	27	28
United Light & Railways of Grand Rapids, preferred	6	58	59
Western Power of San Francisco, common	..	13½	12
Western Power of San Francisco, preferred	6	50½	50
Western Union Telegraph of New York	extra	92⅞	96¼
Industrials—			
Electric Storage of Philadelphia, common	4	49	49
General Electric of Schenectady	8	140¾	142
Westinghouse Electric & Mfg. of Pittsburgh, common	+extra	40	40¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	59	59

*Last sale.